Strategic Research Groups

Tecnológico de Monterrey

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Tecnológico de Monterrey

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Educational Research, Innovate and Transcend

Tecnológico de Monterrey focuses on forming leaders with an entrepreneurial spirit, committed to ethics and citizenship, and who are internationally competitive.

Tecnológico de Monterrey made research its institutional priority in order to:
• Form and educate. We want to make a significant contribution to the quality of the teaching-learning process and form inspiring professors.
• Innovate and transform the scientific and technological knowledge into innovative solutions for the social welfare.
• Transcend, generate and transfer knowledge for the benefit of our nation. We want to face challenges and improve our competitiveness collaborating with the industry and other private and public organizations.

Tecnológico de Monterrey has designed a research-action model: “Research that Transforms Lives”. This model is based on a collaborative, interdisciplinary and open innovation ecosystem which involves faculty and researchers as well as undergraduate and graduate students. Our methodology involves national and international researchers.

Research that Transforms Lives generates innovative solutions for the sustainable economic and social development in Mexico.

41 strategic research groups have been created and their scientific activity is centered on specific challenges related to their disciplines. Taking into consideration their strengths in scientific and educational fields, each group has focused on a few unique research lines. The faculty and researchers of these groups are members of the National Researchers’ System (Sistema Nacional de Investigadores) funded by the Mexican National Council of Science and Technology (CONACYT).

Our researchers are integrated in five Graduate Schools:
• EGADE Business School,
• School of Government and Public Transformation,
• School of Medicine,
• School of Engineering and Sciences and
• School of Education, Humanities and Social Sciences.

This publication provides the profiles of 41 Strategic Research Groups and their lines of investigation.

Arturo Molina Gutiérrez, Ph.D.
Vicepresident of Research, Graduate Studies and Continuous Education
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EGADE Business School

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- Corporate Sustainability
- Entrepreneurship and Leadership
- Finance and Macroeconomics
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- Services Management
- Social Innovation
- Organizational Strategy and Management in Emerging Economies

Consumer Behavior and Value Creation

Research Group with Strategic Focus

Consumer Behavior and Value Creation

Description

We study consumer behavior in order to develop effective business strategies that promote responsible consumption and social welfare.

Research Lines

- Adoption of innovation
- Responsible consumer behavior and social welfare
- Branding strategies
- Cultural meanings of consumption

Recent Publications

- Raquel Castaño, Pérez, María (2014). “A matter of love: Consumers’ relationships with original brands and their counterfeits”, Journal of Consumer Marketing, Vol. 31 Iss:6/7.
- Reimann, Martin, Alex Marin and Raquel Castaño (2014),”The Influence of metaphors on consumers’ creative cognition: Direct, Moderating, and Mediating Effects”, Journal of Consumer Psychology, Vol 24 (2), 290-297.
- Carrete, L. and Arroyo, P. (2014), “Social Marketing to Improve Healthy Dietary Decisions: Insights from a qualitative study in Mexico”, Qualitative Market Research, an International Journal, Vol. 17 No. 3, pp.239 – 263.
- Carrete, L., Arroyo, P. and Trujillo, A. (2014), “Why do Firms Implement Voluntary Environmental Actions and How Are These Activities Evaluated? An Empirical Investigation in Mexico”, Journal of Management and Sustainability, Vol. 4 No. 4, pp. 55-69.

Strategic area: business

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Corporate Sustainability

Research Group with Strategic Focus

Corporate Sustainability

Description

This group promotes transition to innovative business models with emphasis on green growth by encouraging sustainable corporate strategies and public policies that promote green markets and energy transition. The research emphasis is on corporate innovation strategies focusing on eco-efficiency, eco-innovation, greening of value chains and sustainable value creation.

Research Lines

- Corporate sustainability and competitiveness
- Eco-efficient supply chains
- Climate change and energy transition
- Renewable energies for Mexican competitiveness

Recent Publications

- "Casos de éxito de economía verde en países desarrollados: lecciones para América Latina", Los desafíos del crecimiento sustentable con inclusión en América Latina, Buenos Aires, Argentina, Editorial Teseo, 2014
- Designing Integration: Regional Governance on Climate Change in North America (coedited with Neil Craick and Debora Van Njnatten), Toronto University Press, 2013
- Armenta, L. et al (2014), "Impacto de los precios del petróleo en la economía: evidencia de mercados financieros latinoamericanos", Rivas, Castillo y Venegas (coords.): Teoría Económica: un panorama contemporáneo, Panamerican University, UDALAP, IPN, August, Mexico.
- Dan Esty & David Lubin, "Bridging the Sustainability Gap", MIT Sloan Management Review, summer 2014

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Strategic area: business

Entrepreneurship and Leadership

Research Group with Strategic Focus

Entrepreneurship and Leadership

Description

Tecnológico de Monterrey is one of the pioneers in entrepreneurial education in Latin America. Today, the training and development of entrepreneurial leadership continues to be a strategic pillar of our institution. This research group focuses, enhances and disseminates scholarship on entrepreneurship and leadership which strengthen economic and social development in Mexico.

Research Lines

- Entrepreneurship and development
- Families entrepreneurs and family businesses
- Education for entrepreneurship

Recent Publications

- Khoury, T. A. & Prasad, A. (2015) Entrepreneurship amid concurrent institutional constraints in less developed countries. *Business & Society*, 54
- M Valencia-Silva, L Lamolla, JE Amoros. Current Ventures of Women Entrepreneurs: Relating Performance and Goals. 2014. International Journal of Entrepreneurship and Smal Business. ISSNI: 1741-8054
- WA Naudé, Jose Ernesto Amoros, O Cristi. Sugeiting, the appetite may sicken. Entrepreneurs and Happiness. 2014. Small Business Economics. 0921898X
- Prasad, A. 'You can't go home again': And other psychoanalytic lessons from crossing a neo-colonial border. *Human Relations*, 67(2): 233-257. (JIF: 1.938)
- Fotaki, M. & Prasad, A. Social justice interrupted: Values, pedagogy, and purpose of business school academics. Management Learning, 44(1): 103-106. (JIF: 1.582)
- Prasad, A. Playing the game and trying not to lose myself: A doctoral student's perspective on the institutional pressures for research output. *Organization*, 20(6): 936-948. (JIF: 2.356)
- Naranjo-Priego, E. (2014) Los costos sociales y económicos de la Reforma de Derechos Humanos. In *La Reforma Constitucional en Derechos Humanos: El Costo de su Realización Efectiva*. Suprema Corte de Justicia de la Nación.

Strategic area: *business*

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Finance and Macroeconomics

Research Group with Strategic Focus

Finance and Macroeconomics

Description

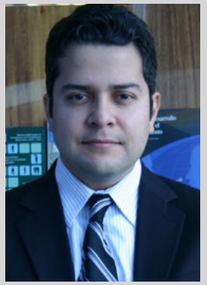
We contribute to the development of Mexican companies through their integration into national and international financial markets. We promote a better understanding of the relation between companies and global macroeconomic conditions.

Research Lines

- Corporate finance and financial markets
- Financial development and economic growth

Recent Publications

- Santillán, Roberto. Market Efficiency during the Mexican Banks privatization announcement, Modern Economy, 2015, 6, 119-132, Published Online January 2015
- Cabral, Rene. “Political Pressure and Procyclical Expenditure: An Analysis of the Expenditures of State Governments in Mexico” (2015) with Andrew Abbott, Philip Jones and Roberto Palacios, European Journal of Political Economy 37: 195-206.
- Cabral, René “Assessing Returns to Education and Labor Shocks in Mexican Regions after NAFTA” (2015), with André V. Mollick, Contemporary Economic Policy 33(1): 190-206.
- Valencia-Herrera, Humberto (2014) “The Stochastic Discount Factor and Liquidity in Mexico and Chile” Journal of Finance & Economics, volume 2, number 1 ISSN 2291-4951 E-ISSN 2291-496X, pp.13 (References 29)
- Ortiz, Alberto. “Estimating Credit Indexation in a Financial Accelerator Model” with Charles Carlstrom, Timothy Fuerst, and Matthias Paustian (2014), Journal of Economics Dynamics and Control, 46(September): 130-149
- Núñez Mora José A. and Mota Aragón Beatriz (2014) Empirical analysis of the Mexican Pension funds returns:their univariate and multivariate probability distributions, Journal of contemporary management pag. 84-91



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Strategic area: business

Innovative Strategies in Global Markets

Research Group with Strategic Focus

Innovative Strategies in Global Markets

Description

The main objective is to analyze and propose models and innovative business strategies in international contexts with emphasis on diverse regions of the world and various market segments.

Research Lines

- Application of business analytics
- International strategies
- Cross cultural studies
- Business at the bottom of the pyramid: migration models

Recent Publications

- Cervantes, M., Lemus, D. & Montalvo, R. (2015). Implementing innovative financial models in different cultures a comparative analysis of China and Mexico. Cross Cultural Management: An International Journal, Forthcoming.
- Montalvo, R., Hernández, C. y Gil, Miguel A. (2014). La Influencia de la Percepción de la Economía en la Confianza del Consumidor: Análisis en México, Estados Unidos y Canadá. Teoría Económica: un panorama contemporáneo. UP, UDLAP, IPN. ISBN: 9786077905134
- Montoya, Miguel; Cuervo, Alvaro. Building Chinese Cars in Mexico: The Grupo Salinas-FAW Alliance" INNOVAR, revista de ciencias administrativas y sociales, (24, 54: 219-230. ISSN 0121-5051). 2014.
- Hernández-Pozas, O. (2015). Ch. 24. Developing Cultural Intelligence using social media. In Vas Taras and Ma-Alejandra Gonzalez-Perez The Palgrave Handbook of Experiential Learning in International Business. UK: Palgrave. Book DOI: 10.1057/9781137467720. Chapter DOI: 10.1057/9781137467720.0024. Ebook ISBNs: 9781137467720 PDF. 9781137467713 EPUB. Print ISBNs: 9781137467706 HB.

Strategic area: business

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Retail

Research Group with Strategic Focus

Retail

Description

This group seeks to develop the retail trade in Mexico in order to achieve international competitiveness by developing strategic thin-king that improves competitiveness through: store experience, operational optimization, use of technology and brand value.

Research lines

- Strategy and operation of retail trade
- Retail trade for emerging channels
- Technology and retail trade
- Brand and customer loyalty
- Store experience

Recent Publications

- Alonso García, Nuria; Chelminski, Piotr; González Hernández, E. M. (2013). Does language matter? An experimental study on the use of English and Spanish in advertising global and national brands, Journal of Current Issues and Research in Advertising, 34 (1), 77-92.ISSN: 1064-1734,
- Andrea Trujillo, Pilar Arroyo y Lorena Carrete. “Do enviromental practices of enterprises constitute an authentic Green marketing Strategy? A case study from México”. International Journal of Business and Management, Vol. 9, No. 2, 2014.
- González, Eva, Felix, Reto, Carrete, Lorena, Centeno, Edgar, y Castaño, Raquel (2014).Green Shades: A segmentation Approach based on Ecological Consumer Behavior in an Emerging Economy, Journal of Marketing Theory and Practice, (Under Revision). ISSN: 1069-6679
- Toldos, M.P. y Orozco, Ma. M. (2014). Brand personality and purchase intention. European Business Review

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Strategic area: business

Services Management

Research Group with Strategic Focus

Services Management

Description

This research group aims to position EGADE Business School as the leading institution in Service Management in Latin America. It has a strategic business approach based on a service logic that contributes to the transformation of professionals, businesses and other organizations in Mexico as well as in other emerging economies. To achieve this goal, our group conducts service research in cutting-edge issues. It designs innovative graduate programs in service management and promotes best-service practices in organizations.

Research Lines

- Service Management at the Base of the Pyramid
- Service-Driven Manufacturing
- Service Innovation and New Service Development
- Service Quality Measurement
- Service Culture and Mindset
- Customer-centric and Service-driven organizations

Recent Publications

- Reynoso, J., Kandampully, J., Fan, X. and Paulose, H. (2015), "Learning from Socially-Driven Service Innovation in Emerging Economies", Journal of Service Management, Vol. 26, No. 1
- Gebauer, H. & Reynoso, J. (2013) "An agenda for service research at the base of the pyramid", Journal of Service Management, Vol. 24, No. 5, pp. 482 - 502.
- Gebauer, H., Guang-Jie, R., Valtakoski, A., and Reynoso, J., (2012), "Service-Driven Manufacturing: Provision, Evolution and Financial Impact of Services in Industrial Firms", Journal of Service Management, Vol. 23, No. 1, pp. 120-136.
- Rubalcaba, L., Michel, S., Sundbo, J., Brown, S., and Reynoso, J., (2012), "Shaping, Organizing and Rethinking Service Innovation: A Multidimensional Framework", Journal of Service Management, Vol. 23, No. 5, pp. 696-715.

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Strategic area: business

Social Innovation

Research Group with Strategic Focus

Social Innovation

Description

We engage in basic and applied research aimed at understanding the function of corporate social responsibility in large multinational corporations and in small and medium-sized enterprises. In addition, we study social, multifaceted entrepreneurship. Furthermore, we evaluate social and ecological costs of doing business in order to identify their causes and to find solutions. Finally, we study related phenomenon of current interest such as voluntary environmental programs and the role of the firm in the creation of income inequality.

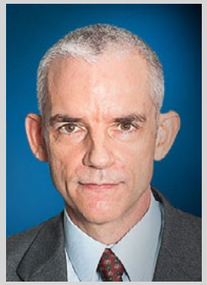
Research Lines

- Ethics and Social Responsibility
- Innovation of responsible and sustainable business models
- Social entrepreneurship and high value start-ups
- Social impact evaluation
- Social innovation
- Sustainable clusters
- Virtual work groups

Recent Publications

- Carneiro, J., Matos, N., & Husted-Corregan, B.. Free markets and social inclusion: Toward a common goal. JOURNAL OF BUSINESS RESEARCH. Estados Unidos de América. pp: 173-176. June . 2015. [2015-81378]
- Husted-Corregan, B.. CSR practice from 1800-1914: Past initiatives and current debates. Business Ethics Quarterly. Estados Unidos de América. January . 2015. [2015-82988]
- Husted-Corregan, B., Crane, A., Henriques, I., & Matten, D.. A New Era for Business and Society. BUSINESS AND SOCIETY. Estados Unidos de América. January . 2015. [2015-82989]
- Scheel-Mayenberger, C., & Pineda-Serna, L.. Innovacities: eje del desarrollo regional sustentable. Colombia. Publicado January . 2015. [2015-84612]

Strategic area: business



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Organizational Strategy and Management in Emerging Economies

Research Group with Strategic Focus

Organizational Strategy and Management in Emerging Economies

Description

In the context of emerging economies, we focus on the research processes and practices related to: strategy development and implementation, organizational capabilities, knowledge transfer, governance and human resources management. We apply strategies and management theories through models and tools designed for decision making and sustainable development for organizations in emerging economies. Theoretical approaches to strategy, institutionalism, culture and stake holdings are the main pillars of our research program.

Research Lines

- Managing people in organizations
- Organizational governance
- Transfer of best practices
- Institutional influences on corporate strategies

Recent Publications

- Alvi, F. H. (2012). Rethinking the institutional contexts of emerging markets through metaphor analysis. Management International Review, 52(4), 519-539.
- Davila, A., and Elvira, M. M. (2012). Humanistic leadership: Lessons from Latin America. Journal of World Business, 47, 548-554.
- Vazquez, M., and Hartmann, A. (2013). Nonmarket strategies of media enterprises in the Mexican television industry. Journal of Business Research, 66(10), 1743-1749.
- Zapata-Cantu, L., Rialp, J. and Rialp, A. (2009). Generation and transfer of knowledge in IT-related SMEs. Journal of Knowledge Management, 13(5), 243-256.

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Strategic area: *business*

School of Education, Humanities and Social Sciences

- Cultural Heritage and Industries: Analysis and Trends
- Global Issues
- Innovation in Educational Models
- Knowledge Societies
- Social Transformation and Sustainability

Cultural Heritage and Industries: Analysis and Trends

Research Group with Strategic Focus

Cultural Heritage and Industries: Analysis and Trends

Description

We understand the term “cultural industry” as a broad perspective that involves the production of cultural goods and services in a non-restrictive and inclusive manner (from popular manifestations to the so-called “high culture”). Its study covers production generated through traditional sectors such as editorial print, analogue or advertising audiovisual material, but also via digital media such as newspapers and online magazines, digital transmission of radio and television programs, social networks, sound and film production, etc. Its contents can be educational, artistic, informative and based on entertainment. These can be considered from the following points of view: emission (authorial democratization), reception (new reading canons, coexistence of different types of receptors and audiences), support (convergent platforms), supporting codes (fragmented, inter-texts favoring), representations (new realities, tempo-spatial breaks) and contexts.

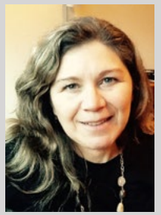
We study these industries as an enabling tool for sustainable development that involves various disciplines such as history, political science, economics, literature, communication, design, marketing, ethics, sociology, education, among others. We use the cultural framework proposed by UNESCO: a) cultural heritage; b) printing and literature; c) music; d) performing arts; e) phonographic media; f) audiovisual media; g) socio-cultural activities; h) sports and games and i) environment and nature.

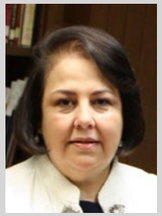
Research Lines

A study of digital humanities and media through the following areas:
- Writing and memory
- Speech and identity
- Art
- History and culture
- Cultural and creative industries
- Culture and urban spaces

Recent Publications

- Irwin, Robert Mckee y Maricruz Castro Ricalde. 2013. *Global Mexican Cinema. Its Golden Age*. London: BFI, Palgrave Macmillan.
- Blanca López de Mariscal y Donna Kabalen, *Recovering the U.S. Hispanic Literary Heritage*, Vol. IX. Arte Público Press, University of Houston, November 30, 2014. ISBN: 978-1-55885-755-1.
- Gonzalez, Rubén A. 2013. *New players, same old game. Change and continuity in Mexican Journalism*. Germany: Lambert Academic Publishing
- Verduzco Garza, Raúl. 2014. *Memoria y resistencia: representaciones de la subjetividad en la novela latinoamericana de fin de siglo*. México: Bonilla Artigas, Tecnológico de Monterrey.





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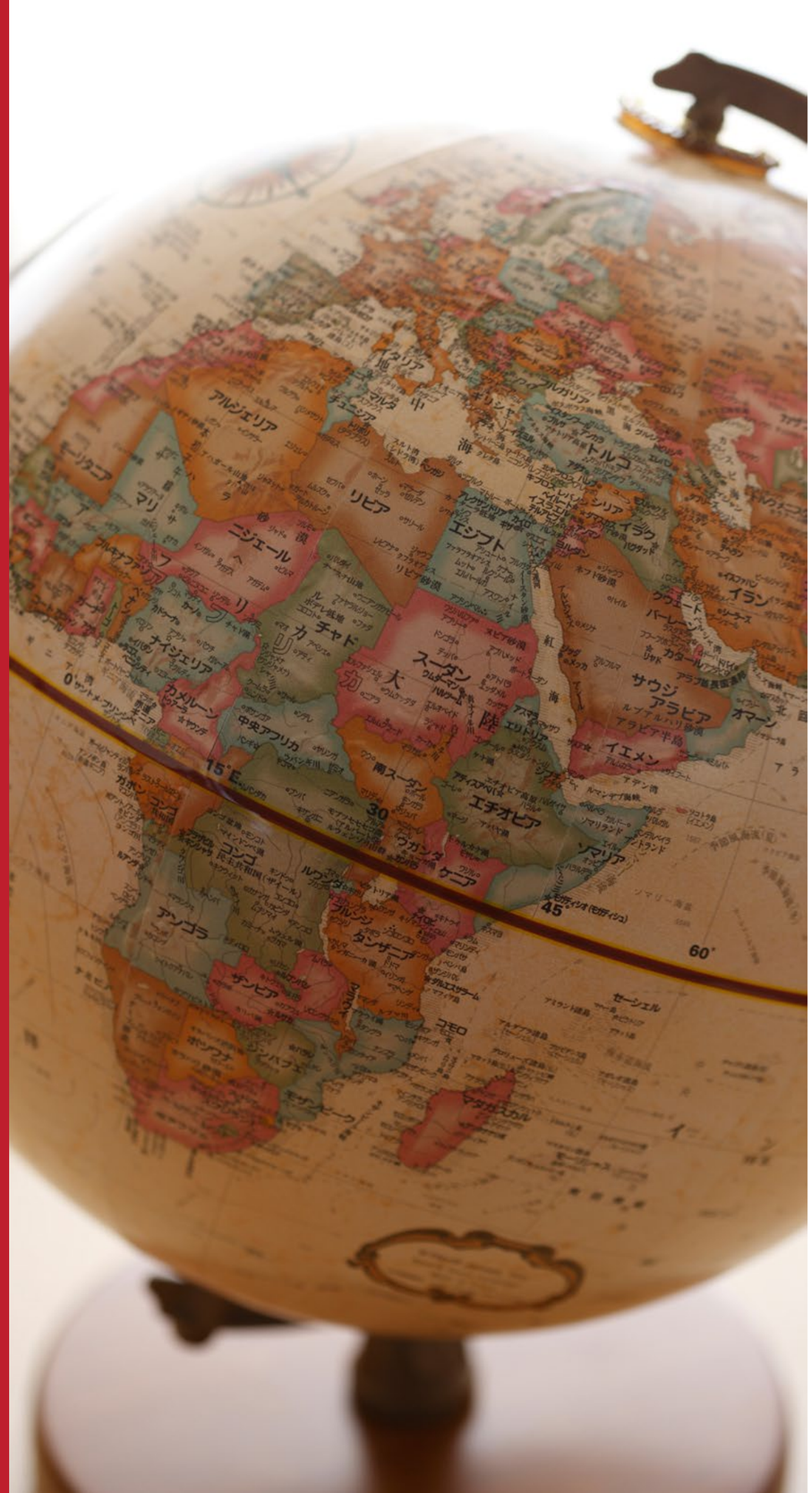
Strategic area: *education, humanities and social sciences*

Global Issues



Research Group with Strategic Focus

Global Issues

Description

This research group consists of scholars working on key contemporary issues of global governance across three main fields: global economic governance, global sustainable development and regional conflicts and cooperation. The research lines of the scholars are complementary, each one addresses important aspects of global governance as well as international cooperation and security. The topics covered are crucial for Mexico and other developing countries that seek solutions to important domestic and foreign policy challenges.

Research Lines

- Foreign Policy and Transnational Issues
- Global economic governance
- Sustainable development
- Regional conflicts and cooperation

Ongoing projects

- Challenges for the establishment of a legal order in the globalized world
- The promise of green politics under capitalism
- The future of nuclear energy after Fukushima
- The role of the G20 since the global financial crisis
- International development cooperation in Latin America
- International security in the age of terrorism
- Mexico's strategies for trade agreements
- Russia's new relation with the West
- New international actors: the case of BRICS
- Aging population in Mexico and business opportunities toward 2030

Recent Publications

- Laborde, Adolfo (2015) *The Mexican Moment*, West Indies University – Ideaz Journal, Jamaica.
- Sánchez Ramírez, Pablo Telman (2015), *El desenvolvimiento y auge del nacionalismo en la Rusia de Vladimir Putin y su influencia directa en la política exterior del Kremlin ¿Regreso del imperio o reacomodo de una gran potencia global?* en Los BRICS y el discurso del Nacionalismo en el siglo XXI. Luis Ochoa y Marisa Pineau (Coordinadores). Editorial Policy Studies Organization's Westphalia Press, Universidad de Buenos Aires y Benemérita Universidad Autónoma de Puebla.
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Strategic area: education, humanities and social sciences

Innovation in Educational Models

Research Group with Strategic Focus

Innovation in Educational Models

Description

This group focuses its research on educational innovation in three main areas: management of educational institutions; sociocultural contexts of the digital technology; and teaching and learning processes for a knowledge-based society in diverse areas with an emphasis on science, mathematics, engineering and technology.
Some of the multidisciplinary research projects and topics include: impact of innovation strategies in education (gamification, inverted classroom), resources (virtual and remote laboratories, augmented reality, open resources), educational environments (e-learning, b-Learning, m-learning, 3D virtual environment, MOOC), virtual communities (academic writing, educational leaders), training (teachers, researchers, entrepreneurs), skills development (ethical, civic, critical thinking, problem solving) and impact assessments (Tecnológico de Monterrey Educational Model: Tec21, public policy programs).

Research Lines

- Management of educational institutions
- Digital technology in sociocultural contexts
- Teaching and learning processes in numerous areas with an emphasis in science, mathematics, engineering and technology for a knowledge-based society

Recent Publications

- Domínguez, A., De la Garza, J., y Zavala, G. (2015, in press). Models and Modeling in an Integrated Physics and Math Course. In Gloria Stillman, María Salett Biembengut, y Werner Blum (Eds), *Mathematical Modelling: History and future perspectives*. Springer.
- García, B. J., Tenorio, G. C. y Ramírez, M. S. (2015). Self-motivation challenges for student involvement in the Open Educational Movement with MOOC. RUSC. *Universities and Knowledge Society Journal*, 12(1), 91-104. Doi http://dx.doi.org/10.7238/rusc.v12i1.2185. Disponible en: http://catedra.ruv.itesm.mx/handle/987654321/853
- Muñoz K., Mc Kevitt P., Lunney T., Noguez J., Neri, L. (2013). An Emotional Student Model for Game-based Learning. In *Technologies for Inclusive Education: Beyond Traditional Integration Approaches*. Giriol D., Callejas Z., López-Cózar R. (Eds). IGI Global. USA. Chapter 9. Pp 175-197. DOI: 10.4018/978-1-4666-2530-3, ISBN13: 9781466625303, ISBN10: 1466625309, EISBN13: 9781466625310. Disponible en: http://www.igi-global.com/book/technologies-inclusive-education/68201
- Valerio Ureña, G. y Valenzuela González, J. R. (2013). Desarrollo del capital social de los estudiantes universitarios a través de las redes sociales en línea. *Intangible Capital*, 9 (4), 971-990. http://dx.doi.org/10.3926/ic.419

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Strategic area: education, humanities and social sciences

Knowledge Societies

Research Group with Strategic Focus

Knowledge Societies

Description

We study the paradigm shift from the material and monetary base of the industrial culture to intangible concepts (ideas and emotions) of the knowledge culture. This new field relies on several specialized areas of knowledge: ethics, epistemology, history of knowledge, economics, sociology of knowledge, political science and psychology as well as technology –particularly ITC and the digital ecosystem– and law.

On these grounds, applications are developed for: studies of science and technology, knowledge and innovation management, scientific and technological intelligence, knowledge economy, knowledge-based development and knowledge cities, cultural and legal aspects of technology, ethics and economic culture.

Research Lines

- Science and technology
- Knowledge, innovation and entrepreneurship management
- Knowledge-based development
- Internet, culture and society
- Law and the Knowledge Society

Recent Publications

- Carrillo, F. , Yigitcanlar, T., García, B. and Lönnqvist A. (2014). *Knowledge and the City: Concepts, Applications and Trends of Knowledge-Based Urban Development*. New York, NY: Routledge.
- Flores F., Rodríguez, B., and García Q. (2015). Building a learning community: A way of teacher participation. *International Journal of Educational Leadership and Management 3*.
- García, H. and Godínez, W. (2014) *Temas Actuales Del Derecho. El Derecho Ante La Globalización*. México: UNAM.
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- Serrano-Bosquet, F. and Caponi G. (2014). Warren Weaver: Valores cognitivos y perspectiva epistemológica del Experimental Biology Program de la Fundación Rockefeller. *Scientiae Studia* 12 (1), 137-167.

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Strategic area: education, humanities and social sciences

Social Transformation and Sustainability

Research Group with Strategic Focus

Social Transformation and Sustainability

Description

Through diverse interdisciplinary theoretical perspectives, this group looks for ways and strategies to ensure the continuation of social processes in the future. It studies basic resources such as water, its relation to life in the cities and its general role in sustainability. Social transformation is analyzed from four points of view: a) The theory about social changes; b) Education; c) Local-global linkage; and d) The "trans" criterion of contemporary social phenomena, especially from the trans-national perspective.
Ethical issues, peace and sustainability are studied from an interdisciplinary and trans-disciplinary perspective encompassing philosophy, literature, law and international relations. We also study the relationship between development and sustainability as well as cultures of peace.
In economic and social aspects, we focus on: evaluation of governmental programs, elections, poverty and inequality, social responsibility and transparency, migration and remittances as well as sub-national public finance.

Research Lines

- Ethics, culture of peace and sustainability
- Economic and social development
- Human rights
- Water and cities
- Social transformation

Recent Publications

- Revista *En-claves del pensamiento*. Revista de Humanidades del Tecnológico de Monterrey, Rectoría Metropolitana de la Ciudad de México, ISSN: 1870-879X
- García González, Dora Elvira, coordinadora. 2014. *Trascender la violencia: críticas y propuestas interdisciplinarias para construir la paz* (México: Porrúa). ISBN: 978-607-09-1662-5.
- Irazuzta, Ignacio, Martínez María (coords.) *De la identidad a la vulnerabilidad*, Barcelona, Ed. Bellaterra, 2014
- González Velázquez, Eduardo. *Ciudadanos a la mitad. Migrantes por doquier*, Guadalajara, Ed. La Jornada, 2014
- Mahlknecht, J. et al (2015, forthcoming), "Urban Groundwater Supply in Latin American Cities: Panorama and the cases of Mexico City and Sao Paulo", in Aguilar-Barajas et al (eds.), *Water and Cities in Latin America: Challenges for Sustainable Development*, London and New York, Eartshcan / Routledge
- Cátedra UNESCO de Ética y Cultura de Paz para el logro de los Derechos Humanos (ratificada en 2014)

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Strategic area: education, humanities and social sciences

School of Government and Public Transformation

- Democracy, Institutions, Security and Justice
- Policies for Urban Transformation, Regional Development and Energy
- Public Economics
- Public Entrepreneurship and Innovation
- Social Policy

Democracy, Institutions, Security and Justice

Research Group with Strategic Focus

Democracy, Institutions, Security and Justice

Description

This group generates research that strengthens democracy and its political and judicial institutions through identification and analysis of the conditions and institutions that promote or limit the consolidation of democracy. The group also supports institutions and public administration processes that improve efficiency and reliability by designing and implementing public policies that promote the constitutional rule of law, especially in the areas of research, administration and justice.

As a group, we seek to influence the public agenda, improve democracy, increase the efficiency of the public administration and consolidate the new criminal justice system. These goals are pursued through the interdisciplinary study of economics, international relations, engineering (computer science, processes, industry, robotics), communication and pedagogy.

Research Lines

- Policy Communication
- Political Institutions
- Citizenship and Political Culture
- Public Finance
- Public Debt
- Supreme Audit
- Financial Accounting
- Policy Negotiation
- Democracy and Public Deliberation
- Society and Civil Government
- Public Policy and Civil Society
- Citizens' role
- International Organizations
- State of International Law
- Human Rights
- American Law
- Law and Public Policy
- Constitutional Law
- Administrative Law
- Governmental Reform
- Democratic Governance

Recent Publications

- Ochman, M. (2015). Consulta ciudadana con método COMPASS: los retos de la deliberación y la efectividad. Intersticios Sociales, 5, 9, ISSN: 2007-4964.
- Torres, P. (2003). La importancia de la incorporación de protocolos de comunicación entre fiscales, policías y peritos en el nuevo sistema de justicia penal (el caso mexicano). Una propuesta de método para su diseño. (2013). Rivista Archivio Penale-Ministero della Giustizia Italiano. N.3. http://www.archiviopenale.it/apw/wp-content/uploads/2013/09/Estrada_Protocolos-comunicaci%C3%B3n.pdf.
- Niedrist., G. (2012). Inmunidad de las Naciones Unidas y Estado de Derecho, en Becerra, Manuel y Gonzalez Martín, Nuria (eds.), Hacía un Estado de Derecho Internacional, UNAM, México City, p. 417-444.http://biblio.juridicas.unam.mx/libros/7/3070/15.pdf

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Policies for Urban Transformation, Regional Development and Energy

Research Group with Strategic Focus

Description

We generate quality research that impacts the public policy in Mexico and in Latin America. We work simultaneously in three major areas: a) Sustainable cities; b) Sustainable regional development, and c) Energy policy and sustainability.
The purpose of our research consists of the following: a) The design of public policies that have a positive impact on urban life in Latin America; b) The design of public policies that raise the regional competitiveness through the use of regional economic development strategies that promote innovation, higher-value-added and creative sectors; and c) The identification of strategic opportunities in the development of the energy sector as well as the environmental and socioeconomic impact caused by the development of the new unconventional hydrocarbon basins, among other contexts.

Research Lines

- Regeneration and urban transformation: sustainable cities
- Regional sustainable development
- Energy policy and sustainability

Recent Publications

- De la Peña, P.; Hernández C.; Molina, A. (2013). Conocimiento Nueva Forma de Capital y Ventaja Competitiva. En Desarrollo Económico de Jalisco: Retrospectiva y Retos. Secretaría de Promoción Económica de Jalisco. Guadalajara, Jalisco. ISBN: 978-607-96055-0-6.
- Villarreal, A., Flores, M. (2014). Exploración de la Geografía de la Innovación en México por medio del análisis de Datos Espaciales. El Trimestre Económico LXXXI(2) 322: 517-544.
http://www.fondodeculturaeconomica.com/Editorial/Trimestre/Detalle.aspx
- Brambila, C. (2014). Capacidades de gobiernos locales: finanzas, planeación y recaudación. Capítulo 7 en libro: Ciudades Sostenibles en México. México- UNFPA.
- Morales, I. (2013). The Twilight of Mexico's State Oil Monopolism: Policy, Economic, and Political Trends in Mexico's Natural Gas Industry ", Belfer Center, Harvard University and James A. Baker III Institute, Rice University, Houston.
http://bakerinstitute.org/research/twilight-mexicos-state-oil-monopolism-policy-economic-and-political-trends-mexicos-natural-gas-indus/

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Strategic area: *Government and Public Transformation*

Public Economics

Research Group with Strategic Focus

Public Economics

Description

We carry out high-level research in order to influence the government in its economic decisions. We highlight issues that are not necessarily in the public agenda to promote social awareness. We publish materials in the field of microeconometrics, social welfare, public sector policies and labor economy basing our studies on mathematics, statistics and health science.

Research Lines

- Public finance
- Microeconometrics
- Welfare
- Sectorial public policies
- Labor economics

Recent Publications

- Absalón, C., Urzúa, C. M. (2013). Impactos distributivos de la reforma fiscal 2010 sobre los hogares en México. Papeles de Población, 19, 201-232.
- Urzúa, C. M. (2013). La persistente situación de pobreza en México. Estudios Empresariales, 142, 51-58.
- Urzúa, C. M. (2013). Distributive and regional effects of monopoly power. Economía Mexicana, 22, 279-295.
- Ricardo Cantú, Antonio Gómez, Bruno López-Videla, Eduardo Rodríguez-Oreggia, Héctor Juan Villarreal (2012). “The worsening of the labor market and its effects on the poverty in Mexico”, CISS-IDRC/World Bank.
- Rocío Fernández, Héctor Juan Villarreal (2012). “Impacto distributivo de un impuesto a los precios de la gasolina en México”, Revista de Administración, Finanzas y Economía, 6(1), Tecnológico de Monterrey.
- Héctor Juan Villarreal (2013). “Presupuestación, el paquete económico en México, y los alcances de la evaluación del desempeño” (ISSN: 2007-5391), Revista Técnica sobre Rendición de Cuentas y Fiscalización Superior, 3(5) pp. 19-32., Auditoría Superior de la Federación.
- Jose E. Urquieta, Hector J. Villarreal (2015). “Evolution of health coverage in Mexico: evidence of progress and challenges in the Mexican health system”, Health Policy and Planning, doi:10.1093/heapol/czv015

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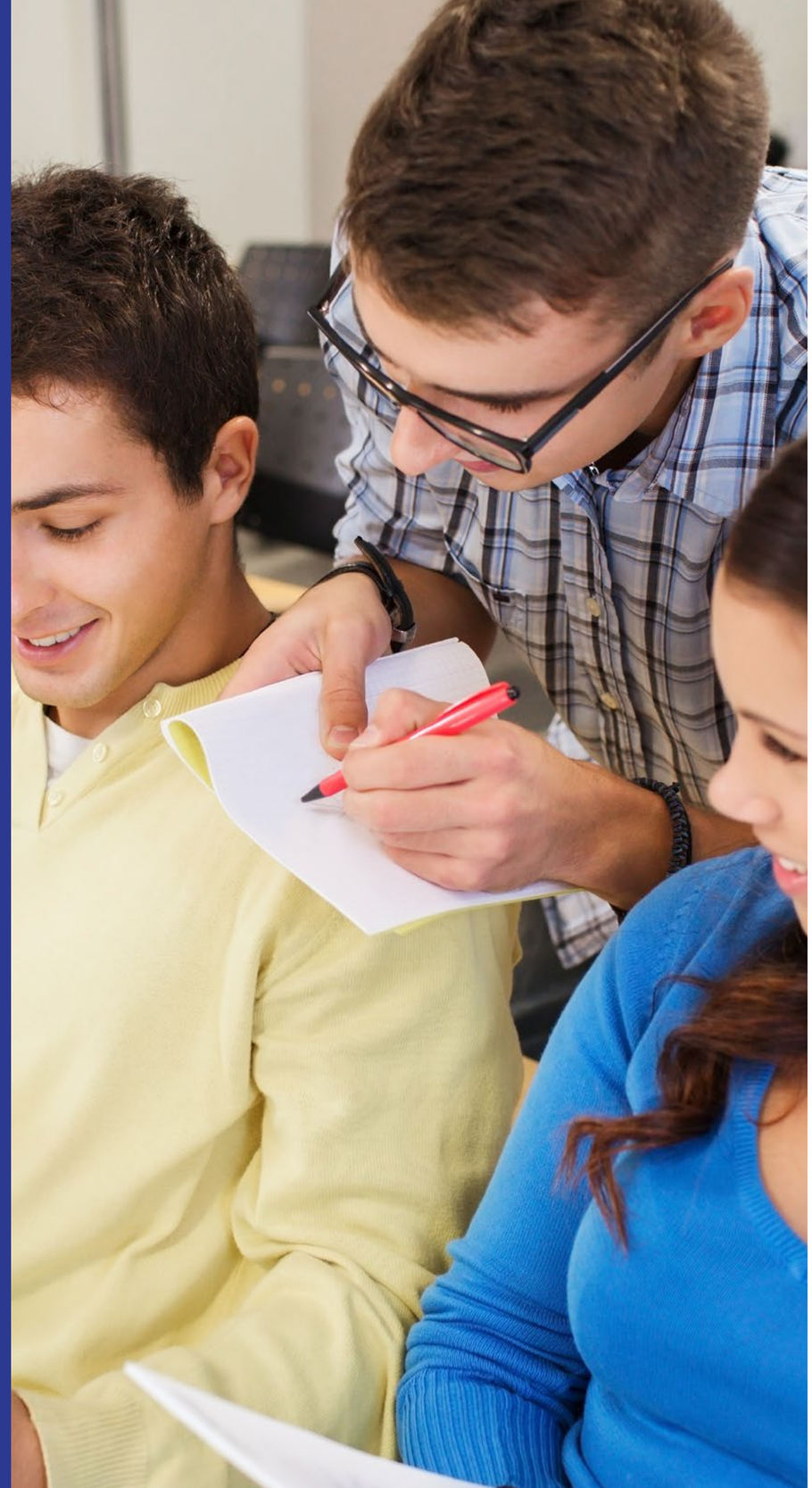
Public Entrepreneurship and Innovation



Research Group with Strategic Focus

Public Entrepreneurship and Innovation

Description

We generate research that provides solutions to the following questions: What can we do to have a better impact: build, rebuild and promote efficient communication and cooperation between the public servants, politicians and citizens as well as between various organization? What role can and should have the predictable technological and anthropological changes? And, how can the public enterprise generate the necessary enthusiasm and participation?

We try to solve these questions by studying entrepreneurship and public productivity, the models of participation and construction of public policy solutions and the technological impact within the public policy. To reach these goals, we study economics, law, political science, demography, sociology and technological innovation.

Research Lines

- Entrepreneurship and public productivity
- Technological Impact and Public Policy
- Models of participation and construction of public policy solutions

Recent Publications

- Poiré, A. (2012). Mexico's Fight for Security: Actions and Achievements, en George Philip y Susana Berruecos (eds.), Mexico's Struggle for Public Security: Organized Crime and State Responses. Studies of the Americas. New York: Palgrave Macmillan, pp. 13-28. http://goo.gl/pVKuY0
- Elizondo, C. (2014). ¿Una nueva Constitución en el 2013? El capítulo económico. Revista Cuestiones Constitucionales, Instituto de Investigaciones Jurídicas, UNAM, número 31, julio-diciembre 2014.

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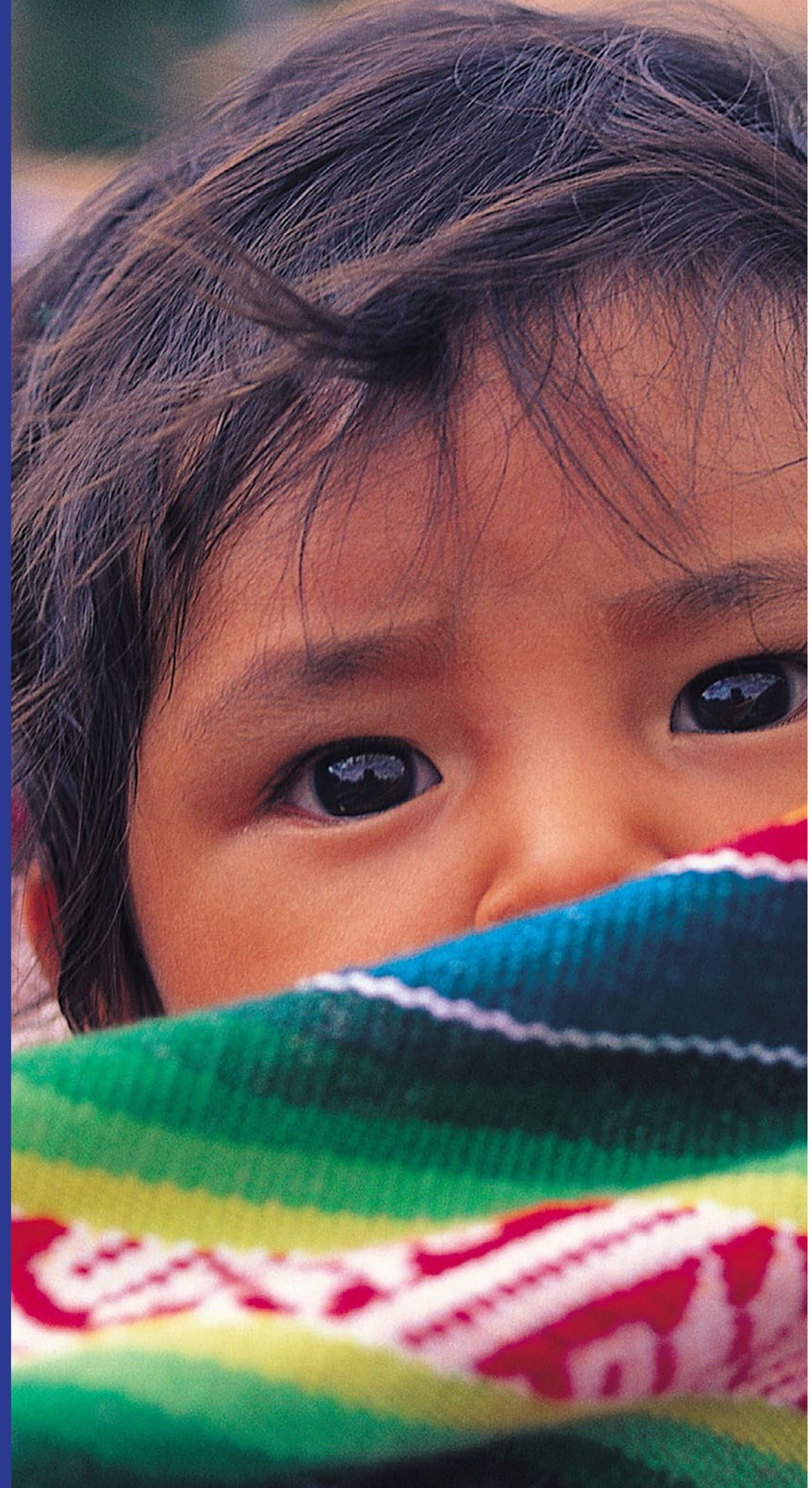
Strategic area: *Government and Public Transformation*

Social Policy



Research Group with Strategic Focus

Social Policy

Description

We generate research that allows us to contribute to changes in the social policy in Mexico that: abate poverty and inequality; contribute to the improvement of education, particularly through the successful implementation of the educational reform in Mexico; strengthen mechanisms for accountability and anti-corruption in the country; and take advantage of the migratory talent dispersion in Mexico that contributes to national development.

To reach these goals, we collaborate actively in the areas of political science, education, business and economics, demography and law.

Research Lines

- Political Economy of Education
- Fiscal Transparency and Combating Corruption
- Poverty
- Econometrics
- General Equilibrium
- Migration and Economic Development
- Public Policy and new local actors

Recent Publications

- Ortega-Díaz, A, Székely, Miguel.(2014) *"Pobreza Alimentaria y Desarrollo en México"*. El Trimestre Económico, vol. LXXXI (1), núm. 321, enero-marzo de 2014, pp. 43-105. https://ideas.repec.org/a/elt/journl/v81y2014i321p43-105.html
- Ortega-Díaz, A. (2013) *"Defining a Multidimensional Index of Decent Work for México"*. The Mexican Journal of Economics and Finance. Volumen 8. Número 1. Enero-Junio 2013. http://www.remef.org.mx/c/images/uploads/documentos/26/4_araceli_ortega.pdf ISNN:1665-5346
- Fernández, M.A. (2014) "El censo educativo: radiografía del dispendio presupuestal". Mexico City: México Evalúa. http://mexicoevalua.org/2014/08/censo-educativo-radiografia-del-dispendio-presupuestal/
- Fernández, M.A. (2013). The Political Economy of Education Reforms in Latin America and the Role of Teachers' Unions in Pursuing an Agenda of Quality of Education The World Bank.
- Rodríguez, H. (2014). Evidencias Empíricas para la Reflexión Migración-Desarrollo: el caso de los migrantes mexicanos en Estados Unidos. Migraciones Internacionales, crisis y vulnerabilidades: perspectivas comparadas. El Colegio de la Frontera Norte. ISBN 978-607479.
- Rodríguez, H. (2012). The emergence of collective migrants and their role in Mexico's local and regional development. Canadian Journal of Development Studies (CJDS). Canadá. Diciembre. http://rimd.reduaz.mx/documentos_miembros/147971.pdf

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School of Engineering and Science

Biotechnology

- Bioprocesses and Synthetic Biology
- Cellular and Bioreaction Engineering
- Emerging Technologies and Molecular Nutrition. Food, Pharmaceutical and Bioproducts Development
- NutriOmics

Mechatronics

- Advanced Manufacturing
- Automotive Consortium
- Industrial Engineering and Numerical Methods
- Nanomaterials and Devices Design
- Nanotechnology
- Product Innovation
- Robotics
- Sensors and Devices

TIC´s

- Information Technologies
- Intelligent Systems
- Optics and Lasers
- Telecomunication and Networks

Sustainable Technologies

- Energy and Climate Change
- Water Science and Technology

Bioprocesses and Synthetic Biology

Research Group with Strategic Focus

Description

Our group focuses on the development of technological platforms based on bioprocesses and synthetic biology that generate new applications, products and production systems. Our main research lines are: a) Design of bioprocesses, b) novel technologies for bioseparation, c) technologies for measurement and early detection and d) synthetic biology.

The bioprocess line focuses primarily on the design, implementation and scaling of unique biotechnological processes for products with commercial potential. The objective of the research line of novel technologies for bioseparation is to generate new strategies for recovery and purification that result in new platforms and products (proteins, enzymes, cells, etc.). The development of technologies for early detection involves the design and use of the micro-devices process for the creation of measurement systems. The research line of synthetic biology focuses on generating unique microbial production systems for obtaining high-value products.

Research Lines

- Design of bioprocesses
- Novel bioseparation technologies
- Measurement technologies and early detection
- Synthetic biology

Recent Publications

- Kiss T, Grievink J, Rito-Palomares M. A systems engineering perspective on process integration in biotechnology. Journal of Chemical Technology and Biotechnology. (2015). IF=2.494.
- Gomez-Loredo A, Gonzalez-Valdez J, Rito-Palomares M. Insights on the Downstream Purification of Fucoxanthin, a Microalgal Carotenoid, From an Aqueous Two-Phase System Stream Exploiting Ultrafiltration. Journal of Applied Phycology. (2015). IF=2.492. In press.
- Mata-Gomez M, Heerd D, Oyanguren-Garcia I, Barbero F Rito-Palomares M. Fernandez-Lahore M. Characterization of a novel pectin-degrading enzyme complex from Aspergillus sojae ATCC 20235 mutants. Journal of Science of Food and Agriculture. (2015). IF=1.879. In press.
- Mayolo-Deloisa K, González-González M, Simental-Martínez J, Rito-Palomares M. Aldehyde PEGylation of laccase from Trametes versicolor in route to increase its stability: Effect on enzymatic activity. Journal of Molecular Recognition. 28, 3, 173–179 (2015). IF= 2.337.
- González-González M, Rito-Palomares M. Application of affinity aqueous two-phase systems for the fractionation of CD133+ stem cells from human umbilical cord blood. Journal of Molecular Recognition. 28, 3, 142-147 (2015). IF= 2.337.

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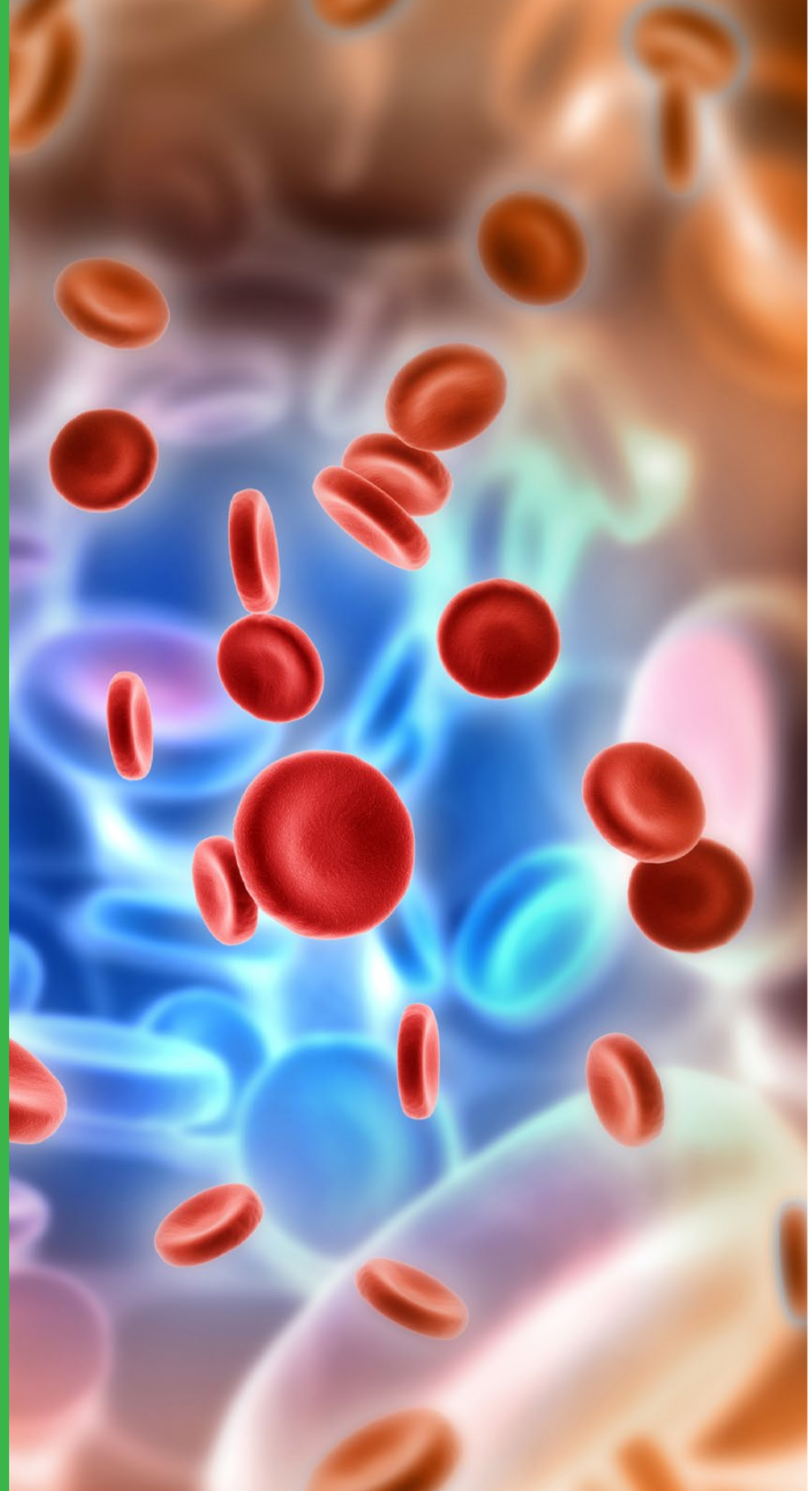
Marco Arnulfo Mata Gómez
Mario Antonio Torres Acosta
Rebeca García Varela
Sergio Ángel García Echauri
Soledad Mora Vásquez

Strategic area: *biotechnology*

Cellular and Bioreaction Engineering



Research Group with Strategic Focus

Cellular and Bioreaction Engineering

Description

Our group generates knowledge, new applications and developments in Pharmaceutical Biotechnology and Biomedicine by combining biological and engineering concepts and tools.

Our main lines of research are: (a) Biopharmaceutical Biotechnology: Production of biopharmaceuticals and recombinant vaccines; (b) Micro- and nanotechnologies for the diagnostic of infectious diseases; (c) Tissue Engineering and stem cell culture; and (d) Engineered biomaterials for biopharmaceutical and biomedical applications.

We use reactions mediated by cells and their components (e.g. enzymes and nucleic acids) to generate high-added-value products and applications. To achieve this purpose effectively, we usually have to engineer the cells and their functions; we use genetic engineering to modify or add new genes to a cell in order to provide it with new functions. For example, we engineer bacteria, yeast and mammalian cells to produce recombinant proteins to diagnose, prevent or treat global infectious or chronic diseases such as influenza, Ebola, cancer, and rheumatoid arthritis. We also design diagnostic chips which quickly and specifically identify bacteria, virus or antibodies and tell us whether a person has been exposed to a specific pathogen.

Recently, we started exploring the area of biomaterials and tissue engineering. Here we combine concepts of material sciences and technology, microfluidics, genomics and cell culture in micro- and mini-devices into biomedical applications that could save lives. For instance, we are developing platforms to culture stem cells for tissue repair. We also culture cancer stem cells in continuous-flow microchips to better understand how a tumor grows and how we could diagnose or treat a specific type of cancer. For these applications, we must design and engineer not only the cells but also the systems and environments where we culture them. That is, we also do bioreactor design and engineering.

Recent publications

• Trujillo-de Santiago G, Portales-Cabrera CG, Portillo-Lara R, Araiz-Hernández D, Del Barone MC, García-López E, Rojas-de Gante C, De Santiago-Miramontes MdA, Segoviano-Ramírez JC, García-Lara S, Rodríguez-González CA, Alvarez MM, Di Maio E, Iannace S. (2015). Supercritical CO2 foaming of thermoplastic materials derived from maize: proof-ofconcept use in mammalian cell culture applications. *PLoS One* (In Press).

• Trujillo-de Santiago G, Rojas-de Gante C, García-Lara S, Ballescá-Estrada A, Alvarez MM. (2014). Studying Mixing in Non-Newtonian Blue Maize Flour Suspensions Using Color Analysis. *PLoS One* 9(11): e112954.

• Genel-Rey T, Carrillo-Cocom LM, Araíz-Hernández D, López-Pacheco F, López-Meza J, Rocha-Pizaña MR, Ramírez-Medrano A, and Alvarez MM. (2014). Comparisson of amino acid consumption in naïve and recombinant CHO cell cultures producers of a monoclonal antibody. *Cytotechnology*, 1-12.

• Garza-García LD, García-López E, Camacho-León S, Rocha-Pizaña M del R, Araiz-Hernández D, López-Pacheco F, López-Meza J, Tapia-Mejía EJ, Trujillo-de Santiago G, Rodríguez-González CA, and Alvarez MM. (2014). Continuous flow micro-bioreactors for the production of biopharmaceuticals: effect of geometry, surface texture, and flow rate. *Lab on a Chip* 14 (7): 1320-1329.

Strategic area: biotechnology

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Emerging Technologies and Molecular Nutrition. Food, Pharmaceutical and Bioproducts Development

Research Group with Strategic Focus

Emerging Technologies and Molecular Nutrition. Food, Pharmaceutical and Bioproducts Development

Description

Through the convergence of different disciplines (Food Engineering, Biotechnology, Chemistry of Materials, Genomics, Microbiology and Nanotechnology) this group promotes emerging and innovative technologies in order to develop and consolidate its research.

Research Lines

- Emerging technology application for the development of innovative processes and creation of bioproducts that satisfy requirements of consumers in sustainable and healthy manners
- Stabilization of materials with applications in biotechnology, pharmaceutical and food industries
- Food. Design based on Nutrigenetic
- Metabolism, production and bioavailability of essential nutrients
- Value added to industrial waste from food industry

Recent Publications

- Zanella-Díaz, E., Mújica-Paz, H., Soto-Caballero, M-C., Welti-Chanes, J. and Valdez-Fragoso, A. (2014). Quick hydration of tepary (Phaseolus acutifolius A. Gray) and pinto beans (Phaseolus vulgaris L.) driven by pressure gradients. LWT - Food Science and Technology. 59:800-805. DOI: 10.1016/j.lwt.2014.05.042. ISSN: 0023-6438. IF: 2.468.
- Martínez, L M., Videa M., López-Silva, G A., de los Reyes, C A, Cruz-Angeles, J, González, N. (2014). Stabilization of amorphous paracetamol based systems using traditional and novel strategies. International Journal of Pharmaceutics. 477, 294-305. DOI:10.1016/j.ijpharm.2014.10.021. ISSN: 0378-5173. IF=3.8
- Castorena-Torres, F., Ramos-Parra, P., Hernández-Méndez, R., Vargas-García, A., García-Rivas, G., and Díaz de la Garza, R. (2014). Natural Folates from Biofortified Tomato and Synthetic 5-methyl-tetrahydrofolate Display Equivalent Bioavailability in a Murine Model. Plant Foods for Human Nutrition. 60(1):57-64. DOI: 10.1007/s11130-013-0402-9. ISSN: 1573-9104. IF= 2.358.
- Lara-Gil, J.A., Álvarez, M.M., & Pacheco, A. (2014). Toxicity of flue gas components from cement plants in microalgae CO2 mitigation systems. Journal of Applied Phycology. 26(1):357-368. DOI: 10.1007/s10811-013-0136-y. ISSN:0921-8971. (Thomson Reuters, 2014) IF=2.326.

Relevant Projects

- Preparation and characterization of amorphous materials for applications in the biotechnology and pharmaceutical industries. Design and construction of instruments for Differential Thermal Analysis (DTA) with academic and research applications
- Development of biodegradable and functional films from agro-industrial waste and nanoparticles
- Vegetal Metabolic Engineering/Biofortification/1C Metabolism/ Metabolomics/ Bioavailability of folates in mammals

Strategic area: *biotechnology*

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NutriOmics

Research Group with Strategic Focus

NutriOmics

Description

This group performs cutting-edge research in nutrigenomics in order to identify phytochemicals, preferably the ones associated with Mexican native plants and foods that have the potential to prevent and treat cancer and chronic degenerative diseases. Important efforts are implemented to extract, identify and isolate phytochemicals, perform in-vitro tests with human and mammalian cells as well as animal tests in laboratory. Additionally, bioprocesses will be developed to obtain tablets, pills and products with nutraceutical and / or pharmacist degrees. The mechanisms with which phytochemicals prevent or treat chronic-degenerative diseases (diabetes, inflammation, cholesterol and cancer) will be studied by nutrigenomic techniques. The development of vegetable proteins for food applications, aimed to replace expensive animal proteins, is another important research task of our group. Novel raw materials are being identified, structural modifications of macromolecules are made, novel processes to improve efficiency and functionality of the extraction will be developed as well as the application of proteins in the development of food (dairy, cereals, beverages and others). Biotech also studies the minimization of post-harvest loss of grains and especially molecular markers that increase the nutraceutical capacity of cereals and other grains. This line also studies the processing of the nutraceutical capacity of grain-based foods. This group will also focus on the creation of a laboratory which processes and does research on the generation of tablets and pills that can be used in clinical studies. This group will do research in the area of genomics.

Research Lines

- Nutrigenomics
- Development of plant proteins
- Identification of molecular markers in cereals and grains
- Generation of tablets and pills for trial studies

Recent Publications

- The effect of isorhamnetin glycosides extracted from *Opuntia ficus-indica* in a mouse model of diet induced obesity. César Rodríguez-Rodríguez, Nimbe Torres, Janet A. Gutiérrez-Uribe, Lilia G. Noriega, Iván Torre-Villalvazo, Ana M. Leal-Díaz, Marilena Antunes-Ricardo, Claudia Márquez-Mota, Guillermo Ordaz, Rocío A. Chavez-Santoscoy, Sergio O. Serna-Saldivar, Armando R. Tovar Food and Function, 2015, DOI: 10.1039/C4FO01092B
- Functionality and organoleptic properties of maize tortillas enriched with five different soybean proteins. Cristina Chuck-Hernandez, Esther Perez-Carrillo, Cinthya Soria-Hernández, Sergio O. Serna-Saldivar Cereal Chemistry, 2015, http://dx.doi.org/10.1094/CCHEM-07-14-0154-R
- Genetic mapping of QTL for maize weevil resistance in a RIL population of tropical maize. Fernando F. Castro-Álvarez, Manilal William, David J. Bergvinson, Silverio García-Lara. Theoretical and Applied Genetics, 2015, 128: 411-419
- Effect of thermal process and filtration on the antioxidant activity and physicochemical parameters of Agave atrovirens extracts. Víctor Olvera-Garcia, Anaberta Cardador-Martinez, Sandra Teresita Martín del Campo. Journal of Food Research, 2014, 4 (1), p155

Patents

- Cancer cell growth inhibition by black bean (Phaseolus vulgaris L) extracts Janet A. Gutierrez-Uribe, Sergio R. O. Serna-Saldivar, Jorge E. Moreno-Cuevas, Carmen Hernandez-Brenes, Elsa M. Guajardo-Touche US 7,763, 292 B2
- Agave syrup extract having anticancer activity. Janet A. Gutierrez-Uribe, Sergio R.O. Serna-Saldivar. US Patent 8,470,858
- Using immobilized invertase to convert sucrose into glucose and fructose; food processing. Sergio R. Serna-Saldivar, Marco A Rito-Palomares US Patent 7,435,564
- Antimicrobial, antibacterial and spore germination inhibiting activity from an avocado extract enriched in bioactive compounds. Carmen Hernandez-Brenes, María Isabel Garcia-Cruz, Janet A. Gutierrez-Uribe, Jorge Alejandro Benavides-Lozano, Dariana Graciela Rodriguez-Sanchez. US Patent App. 13/763,262

Strategic area: biotechnology

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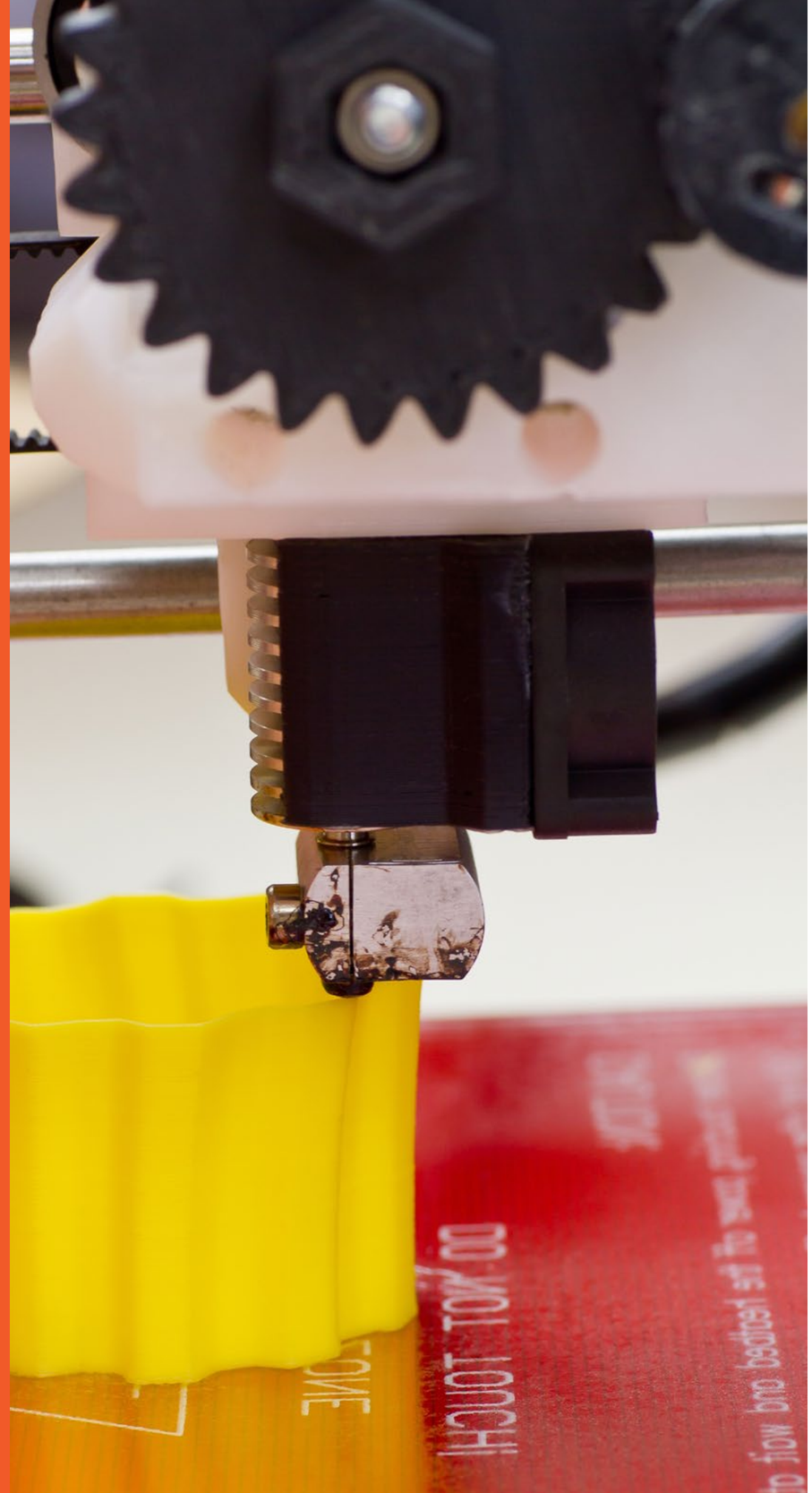
Advanced Manufacturing



Research Group with Strategic Focus

Advanced Manufacturing

Description

This group focuses on applied research related to the design and manufacture of products with high added value using disciplines such as competitive intelligence, circular economy, biomanufacturing, additive manufacturing, precision engineering and laser-based microprocessing. The complete life cycle of the product is studied through competitive intelligence, circular economy, ecodesign and green manufacturing concepts. Some of the advanced manufacturing processes of interest to this group include: 3D printing of tissue engineering scaffolds, electrospinning of nanofibers, laser microcutting and microwelding, soft lithography for microfluidics, microinjection molding, micromilling, incremental sheet forming and metrology.

Research Lines

- Additive manufacturing and laser-based processing
- Biomanufacturing
- Circular economy and ecodesign
- Competitive intelligence
- Metrology and precision engineering

Recent Publications

- Criales, L. E., Orozco, P. F., Medrano, A., Rodríguez, C. A., & Özel, T. (2015). Effect of Fluence and Pulse Overlapping on Fabrication of Microchannels in PMMA/PDMS via UV Laser Micromachining: Modeling and Experimentation. Materials and Manufacturing Processes, (published on line).
- Elías-Zúñiga, A., Montoya, B., Ortega-Lara, W., Flores-Villalba, E., Rodríguez, C. A., Siller, H. R., Díaz-Elizondo, J.A., Martínez-Romero, O. (2013). Stress-softening and residual strain effects in suture materials. Advances in Materials Science and Engineering, Article ID 249512.
- Lynn, N. S., Martínez-López, J. I., Bocková, M., Adam, P., Coello, V., Siller, H. R., & Homola, J. (2014). Biosensing enhancement using passive mixing structures for microarray-based sensors. Biosensors and Bioelectronics, 54, 506-514.
- Rodriguez, M., Palacios, A., & Cortez, D. (2014). Technical Intelligence Approach: Determining Patent Trends in Open Die Forging. Journal of Intelligence Studies in Business, 4(1), 5-15.
- Vallejo, C., Romero, D., & Molina, A. (2012). Enterprise integration engineering reference framework and toolbox. International Journal of Production Research, 50(6), 1489-1511.

Strategic area: mechatronics

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Automotive Consortium

Research Group with Strategic Focus

Automotive Consortium

Description

This group focuses on the development of modern transportation systems, particularly the ones associated with the automotive industry. The main research topics of our group are: virtual prototyping, the use of new light materials and multimaterial components in the structure, the reduction of the body and drivetrain of the vehicle; the development of powertrains equipped with electric motors; the integration of structures and modular systems for vehicle design; vehicle connectivity to networks; the development of dynamic characterization and automotive control systems; the overall behavior analysis of vehicles for comfort; and the increase in maneuverability and stability using stabilizing devices. Several companies are participating as co-sponsors and users of our research and results.

Research Lines

- Virtual prototyping
- Dynamic characterization and control of automotive systems
- Design and automotive engineering
- Design of systems for conventional/electric powertrain
- Design of systems which permit vehicle connectivity
- Design of light modular structures
- Design, fabrication and testing of multimaterial / lightweight material components

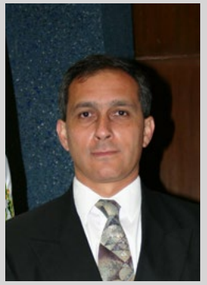
Recent Publications

- Coronado, Pedro Daniel Urbina, and Horacio Ahuett–Garza. “Analysis of energy efficiency and driving range of electric vehicles equipped with a bimotor architecture propulsion system.” International Journal of Electric and Hybrid Vehicles 6.2 (2014): 152-177.
- Urbina Coronado, P. D., Ahuett-Garza, H., Sundaresan, V. B., & Morales-Menendez, R. (2014). Development of an Android OS Based Controller of a Double Motor Propulsion System for Connected Electric Vehicles and Communication Delays Analysis. Mathematical Problems in Engineering.
- J Lozoya-Santos, R. Morales-Menendez, and R Ramírez-Mendoza Evaluation of On–Off Semi-Active Vehicle Suspension Systems by using the Hardware-in-the-Loop Approach and the Software-in-the-Loop Approach., Proc of the Institution of Mechanical Engineers Part D-Journal of Automobile Eng (P I MECH ENG D-J AUT), ISSN: 0954-4070, Proc of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering January 2015 vol. 229 no. 1 pp: 52-69
- Efficient Modeling of MR Dampers.Jorge de J. Lozoya-Santos, Rubén Morales-Menéndez, Ricardo A. Ramírez-Mendoza, Horacio Ahuett-Garza. IEEE Latin America Transactions 06/2014; 12(4):550-556.

Patents (in process)

- Sistema de Control para Mejorar el Confort y Maniobrabilidad de Vehículos Automotrices. Jorge de J. Lozoya-Santos, Ricardo A. Ramírez-Mendoza, Rubén Morales-Menéndez Ref. No: Expediente: MX/a/2014/002554 Folio: MX/E/2014/015705, Year: 03/2014
- Absorbedor Dinámico de Vibración. José L. Flores-Quintanilla, Ricardo A. Ramírez-Mendoza, Rubén Morales-Menéndez Ref. No: Expediente: MX/a/2014/000351 Folio: MX/E/2014/001816, Year: 01/2014

Strategic area: mechatronics



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Industrial Engineering and Numerical Methods

Research Group with Strategic Focus

Industrial Engineering and Numerical Methods

Description

Our group develops approaches, formulations and solutions to specific industrial engineering problems using a quantitative point of view. We solve production and logistics problems such as planning and production scheduling, facility location, inventory, vehicle routing, territorial design, forest management and port logistics. The approach is quantitative, it provides formulation and solution to problems by designing algorithms that allow us to obtain both exact and approximate solutions.

Research Lines

• Logistics and manufacturing

Recent Publications

• Iris Martínez-Salazar, Francisco Angel-Bello, Ada Alvarez. A customer-centric routing problem with multiple trips of a single vehicle. Journal of Operational Research Society, 2014 (published on line). ISSN: 0160-5682. doi:10.1057/jors.2014.92
• Avalos-Rosales O., Angel-Bello F., Alvarez A. Efficient metaheuristic algorithm and re-formulations for the unrelated parallel machine scheduling problem with sequence and machine dependent setup times. International Journal of Advanced Manufacturing Technology, (2015), 76, 1705-1718, 2014. ISSN: 0268-3768
• Belén Melián, Alondra de Santiago, Francisco Angel Bello, Ada Alvarez. A Bi-objective Vehicle Routing Problem with Time Windows: a real case in Tenerife. Applied Soft Computing, 17, 140-152, 2014. ISSN: 1568-4946
• Iris Martínez, Julián Molina, Francisco Angel Bello, Trinidad Gómez, Rafael Caballero. Solving a bi-objective Transportation Location Routing Problem by metaheuristic algorithms. European Journal of Operational Research, 234, 25-36, 2014. ISSN: 0377-2217
• Roberto Guerra-Olivares, Rosa González-Ramírez, Neale R. Smith (2015) A heuristic procedure for the outbound container relocation problem during export loading operations. Mathematical Problems in Engineering, published on line only.
• Jaime Castro Pérez & José Ríos Montes (2012): FBN Modules, Communications in Algebra, 40:12, 4604-4616

Strategic area: mechatronics

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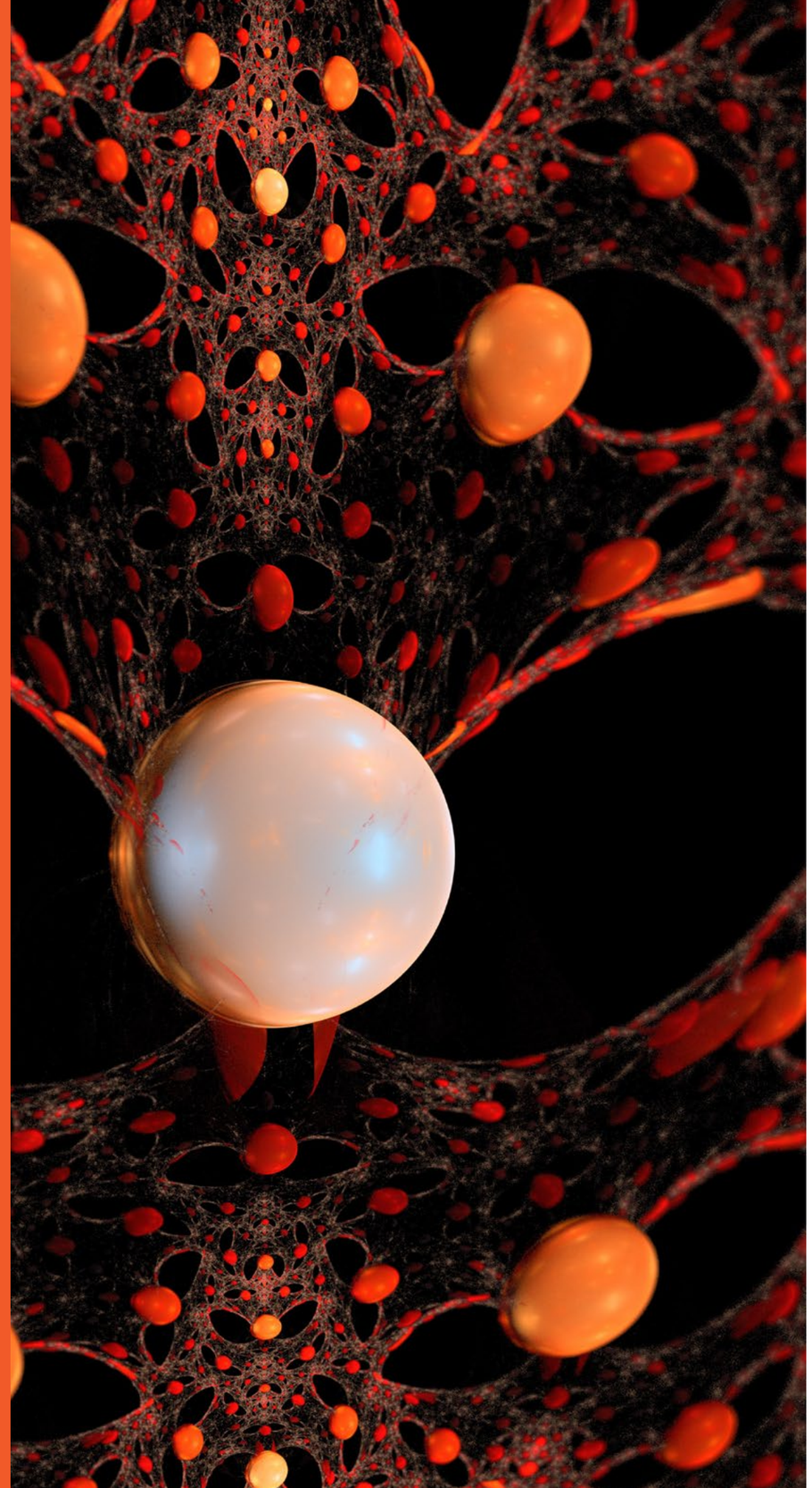
Nanomaterials and Devices Design



Research Group with Strategic Focus

Nanomaterials and Devices Design

Description

This research group focuses on: a) The development and characterization of intelligent and morphing biocompatible polymeric materials reinforced with carbon nanotubes or nanoparticles, b) the development of cutting edge technology to manufacture devices based on nanostructured materials, c) the prediction of the dynamic response of linear and non-linear systems using perturbation techniques, nonlinear modal analysis and cutting-edge experimental techniques, d) The computer simulation of engineering components with Finite Element Analysis.

Research Lines

- Development and characterization of nanostructured biocompatible materials
- Development of nanostructured devices by using high manufacturing techniques such as Ultrasound injection molding and Incremental Sheet forming
- Prediction of the modal response of linear and nonlinear dynamic systems by using perturbation techniques
- Modeling and Analysis of Machining Processes of super alloys and thin floor components
- Theoretical modeling and computer simulations of devices based on nanostructured materials

Recent Publications

- Soto, Matias; Boyer, Travis; Biradar, Santoshkumar; Ge, Liehui; Vajtai, Robert; Elias-Zuniga, Alex; Ajayan, Pulickel; Barrera, Enrique. Effect of interwall interaction on the electronic structure of double-walled carbon nanotubes, NANO. Accepted for Publication, 2015.
- Isabel Bagudanch, M.Luisa Garcia-Romeu, G. Centeno, A. Elias-Zúñiga, J. Ciurana, Forming force and temperature effects on Single Point Incremental Forming of Polyvinylchloride. Journal of Materials Processing Technology, Volume 219, May 2015, Pages 221–229.
- D. Olvera, A. Elías-Zúñiga, L. N. López de Lacalle, and C. A. Rodríguez, “Approximate Solutions of Delay Differential Equations with Constant and Variable Coefficients by the Enhanced Multistage Homotopy Perturbation Method,” Abstract and Applied Analysis, Article ID 382475, 2014.
- A. Elías-Zúñiga, Solution of the damped cubic-quintic Duffing oscillator by using Jacobi elliptic functions. Applied Mathematics and Computation. Volume 246, 1 November 2014, Pages 474–481.

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Strategic area: mechatronics

Nanotechnology

Research Group with Strategic Focus

Nanotechnology

Description

This group focuses on the surface engineering by assisted plasma. Main research topics are: Prototype design and construction for the thermochemical treatment of steel parts as well as prototypes for physical vapor deposition (PVD); Nitriding, carbonitriding and oxy- carbonitriding of steels (stainless steels 316L, special steels as “Incaloy”, and titanium based alloys Ti6Al4Va); Thin film coatings on substrates for tribological systems, high performance components and metal dusting improvement that are required for applications in metalworking, automotive, aerospace and biomedical industry; Development of piezoelectric materials used as sensors. The built prototypes allow us to produce multilayer and multicomponent coatings with plasmas generated by DC, RF and microwave fields.

We also develop mathematical representation of kinetics growth in concomitant nitride layers as well as the mathematical representation of the effects in operating parameters related with the characteristics of thin films. We also perform the structural characterization of a wide variety of steels and thin films using scanning electron microscopy, transmission X-ray diffraction as well as micro and nano hardness and bolt testing.

Research Lines

- Design and construction of prototypes for plasma-assisted treatments
- Synthesis of multicomponent and nanostructured thin films
- Structural and mechanical characterization of multicomponent and nanostructured thin films
- Process characterization using optical emission spectroscopy techniques
- Mathematical modeling of phase transformations in treated components

Recents Publications

- Residual stresses in injection molded products. Autores: A. Guevara Morales U. Figueroa López. Fecha de publicación 2014. Revista: J. Mater Science Volumen 49 Páginas 4399-4415 Editor Springer
- Development of Al oxide PVD coatings against metal dusting. Autores: E. Uribe, O Salas, D Melo-Máximo, J Oseguera, CM Lepienski, RD Torres, RM Souza. Fecha de publicación: 2015/2. Revista Surface Engineering, Volumen 31, Número 2 Páginas 114-122, Editor Maney Publishing
- Performance of MPPMS Cr/Cr2O3 films in protection against metal dusting Autores: L Melo-Máximo, M Pérez, J Lin, O Salas, D Melo-Máximo, J Oseguera, VM López-Hirata, RD Torres, RM Souza. Fecha de publicación: 2015/2. Revista Surface Engineering. Volumen 31, Número 2, Páginas: 166-172, Editor: Maney Publishing
- Modeling surface processes and kinetics of compound layer formation during plasma nitriding of pure iron. Autores: F León Cázares, A Jiménez Ceniceros, J Ose-guera Pena, F Castillo Aranguren. Fecha de publicación: 2014 Revista Mexicana de Física growth. Volumen 28. Páginas 29

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Rafael Carrera Espinoza

Strategic area: mechatronics

Product Innovation

Research Group with Strategic Focus

Product Innovation

Description

We investigate state of the art concepts and generate significant contributions related to the identification of demand from Rapid Growing Markets as well as characterization and application of accelerating technologies for product and process innovations. We also design and create reference models, methodologies and tools for Rapid Product Innovation and Realization. Our group creates and builds conceptual and functional prototypes of products in the areas of advanced manufacturing technologies (micro-machines/micro-factories, 3D printers), sustainable technologies (solar energy, smart grids, green houses) as well as bio-medical devices and intelligent robots.

Research Lines

- Framework, models and methodologies for the integrated development of products, processes and production systems
- Models, methods, techniques and information technologies for the accelerated product development
- Use of emerging technologies for product development

Recents Publications

- Hiram Ponce, Pedro Ponce and Arturo Molina, 2105, The development of an artificial organic networks toolkit for LabVIEW, J. Comput. Chem. 2015, 36, 478–492. DOI: 10.1002/jcc.23818
- Pedro Ponce, Arturo Molina, Hector Bastida, Brian MacCleery, 2015, Real-time hardware ANN-QFT robust controller for reconfigurable micro-machine tool, The International Journal of Advanced Manufacturing Technology, 2015, 1-20, Springer London.
- Roberto Pérez, Arturo Molina and Miguel Ramirez, 2014, An Integrated View to Design Reconfigurable Micro/Meso-Scale CNC Machine Tools, J. Manuf. Sci. Eng. 136(3), 031003 (Mar 26, 2014), Paper No: MANU-12-1220; doi: 10.1115/1.4025405
- Arturo Molina, Hiram Ponce, Pedro Ponce, Guillermo Tello, Miguel Ramírez, 2014, Artificial hydrocarbon networks fuzzy inference systems for CNC machines position controller, The International Journal of Advanced Manufacturing Technology, June 2014, Volume 72, Issue 9-12, pp 1465-1479
- Arturo Molina, Pedro Ponce, Miguel Ramirez, Gildardo Sanchez-Ante, 2014, Designing a S2-Enterprise (Smart x Sensing) Reference Model, Collaborative Systems for Smart Networked Environments, IFIP Advances in Information and Communication Technology Volume 434, 2014, pp 384-395.
- Osorio, J., Romero, D. ; Betancur, M. ; Molina, A., 2014, Design for sustainable mass-customization: Design guidelines for sustainable mass-customized products, Engineering, Technology and Innovation (ICE), 2014 International ICE Conference on, 23-25 June, pp. 1 – 9, INSPEC Accession Number: 14516645, Bergamo, DOI: 10.1109/ICE.2014.6871560, Publisher: IEEE

Patents

- Ramírez Cadena, Miguel de Jesús (P); Molina Gutiérrez, Arturo (P); Valenzuela Grijalva, Eduardo Antonio (A). SISTEMA DE CONTROL NUMÉRICO RECONFIGURABLE PARA LA AUTOMATIZACIÓN Y ACTUALIZACIÓN DE MAQUINAS-HERRAMIENTA. México. Solicitud: 2008-12-19. No. REGISTRO: MX/a/2008/016470. Propiedad ITESM. Patente. PUBLISHED.
- Pedro Ponce Cruz, Fernando David Ramírez, Hiram Eredin Ponce Espinosa, Intelligent Control Toolkit, US 20100138364 A1, U.S. Provisional Application No. 61/197,484, filed Oct. 28, 2008. REGISTER.

Strategic area: mechatronics

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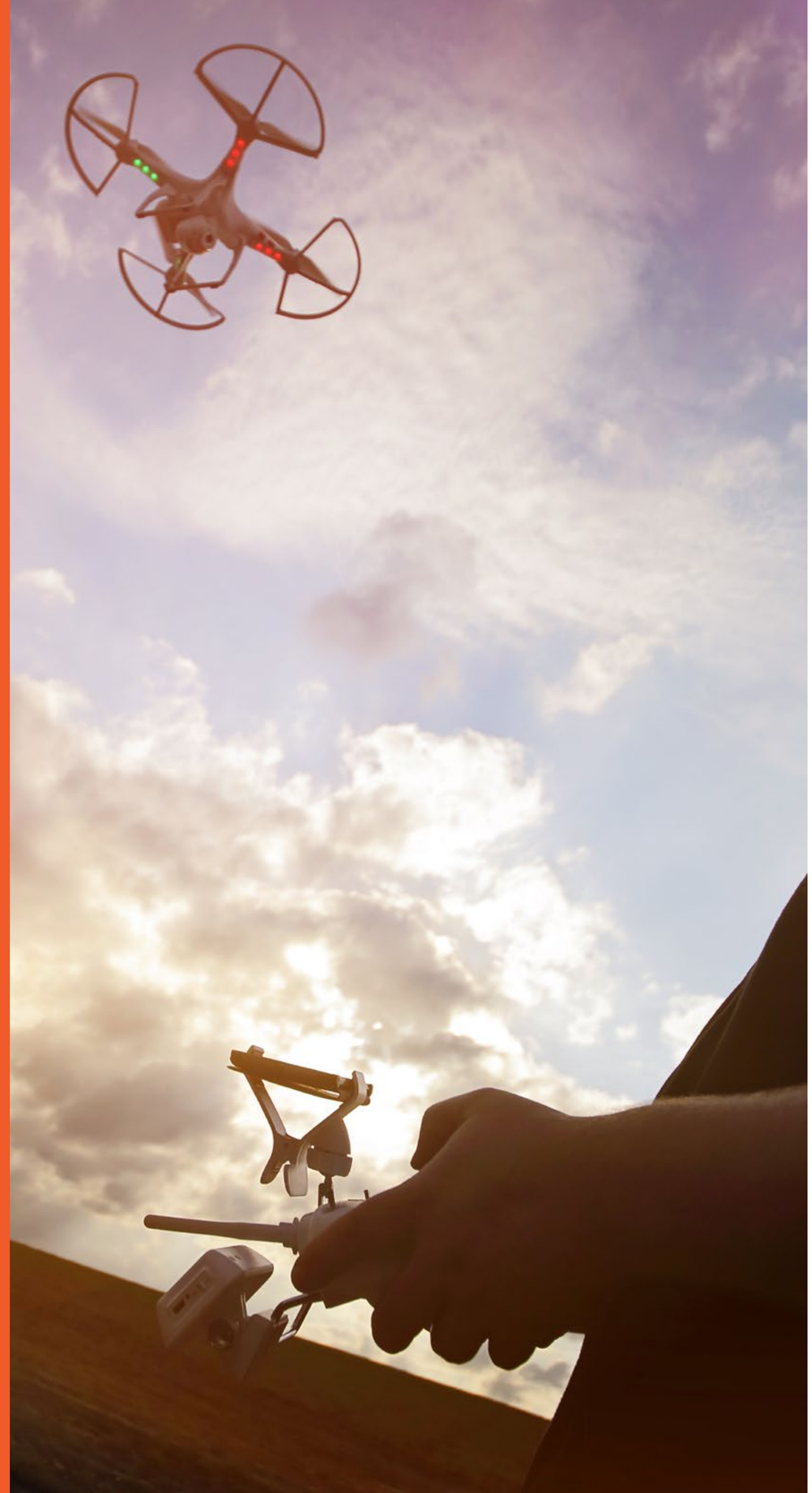
Robotics



Research Group with Strategic Focus

Robotics

Description

Our group develops devices in the areas of bio-mechatronics and autonomous vehicles. In the bio-mechatronics area, the objective is to assist the human motion during rehabilitation and to help geriatric people with wearable robotics. In the case of autonomous vehicles (AV's), we focus on the assistance during natural disasters by using teams of heterogeneous robots (air and ground AV's) that interact simultaneously.

Research Lines

- Bio-mechatronics
- Autonomous vehicles

Facilities

National Laboratory on Robotics with the specialized areas: Laboratory for Micro-Robotics and Laboratory for Autonomous Vehicles. This Laboratory is supported by CONACyT and the Tecnológico de Monterrey.

Recent Publications

- Cepeda JS, Chaimowicz L, Soto R, Gordillo JL, Alanís-Reyes EA, Carrillo-Arce LC. A Behavior-Based Strategy for Single and Multi-Robot Autonomous Exploration. Sensors. 2012; 12(9); pp. 12772-12797.
- C. Hernández-Santos, E. Rodriguez-Leal, R. Soto, J.L. Gordillo. Kinematics and Dynamics of a New 16 DOF Humanoid Biped Robot with Active Toe Joint. Int J Adv Robot Syst, 2012, 9:190.
- J. Rodriguez, A. Garcia-González , T. Poznyak, I. Chairez and A. Poznyak. Modeling the phenanthrene decomposition adsorbed in soil by ozone: Model charac- terization and experimental validation (Acepted, In press). Water, Air, & Soil Pollution.
- C. Escolano, J. M. Antelis, and J. Minguez. A telepresence mobile robot controlled with a non-invasive brain-computer interface. IEEE Transactions on Systems, Man, and Cybernetics-Part B: Cybernetics, Vol. 42, no. 3, pp. 793–804, June 2012
- Aguilar, A., Roman-Flores, A., & Huegel, J. C. (2013). Design, refinement, implementation and prototype testing of a reconfigurable lathe-mill. Journal of Manufacturing Systems, 32(2), 364-371.

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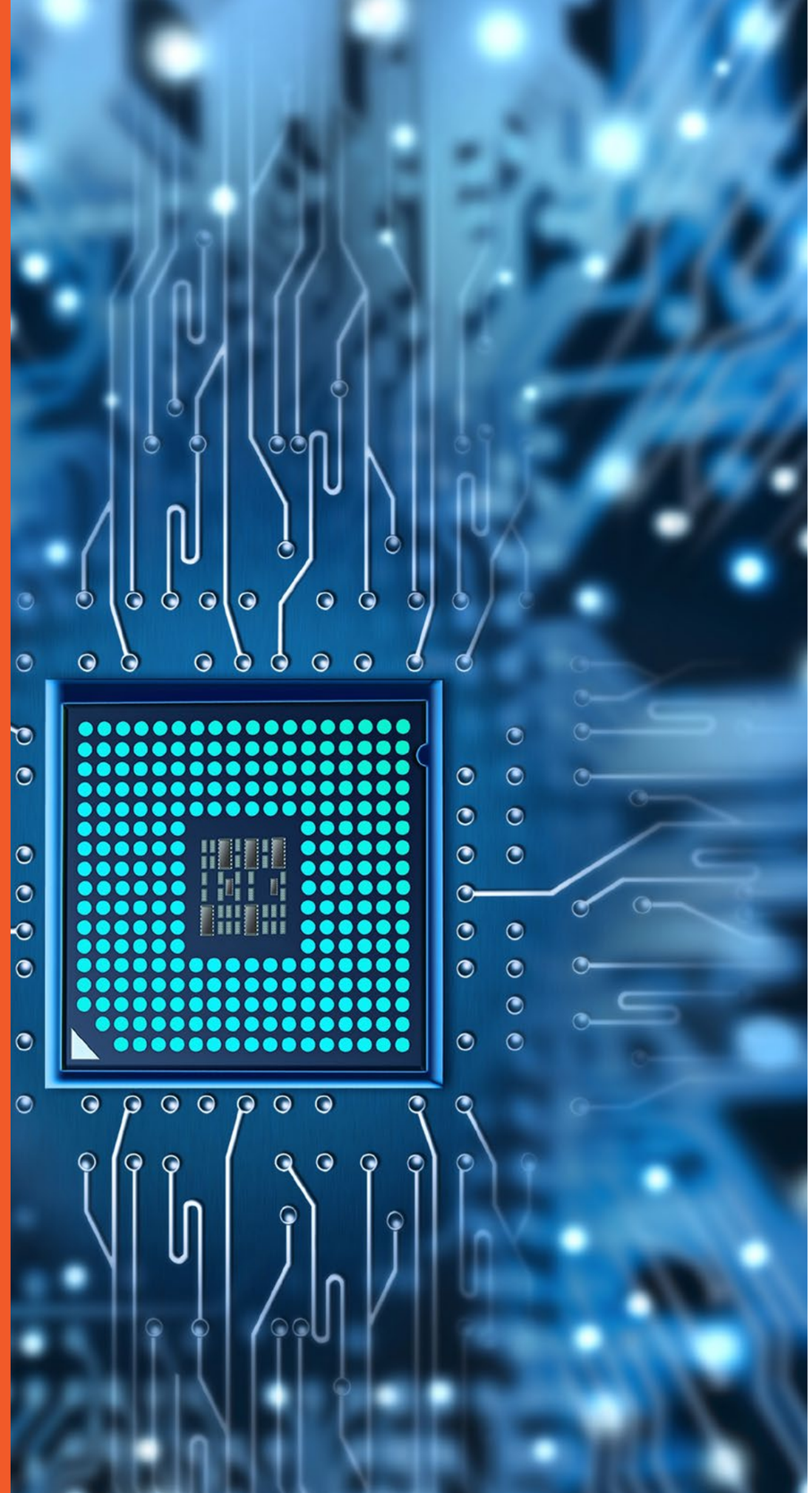
Strategic area: mechatronics

Sensors and Devices



Research Group with Strategic Focus

Sensors and Devices

Description

This group develops micro/nanofabrication processes and novel miniaturized sensors and devices, particularly photonic and electrochemical sensors, as well as micro-labs on a chip. These sensors and devices are fabricated with various materials, such as metals, polymers and carbon, and can integrate *ad-hoc* microelectronic systems.
The group deals mainly with, but is not limited to: applications related to environmental monitoring, such as sensor networks that monitor groundwater and air pollutants produced by industrial activity; separation and processing of biological materials used for new drugs; the analysis of biological fluids for the prevention, detection and monitoring of diseases; and the development of devices for monitoring and improving cell culture.
The group's experimental facilities include: a laboratory for fabrication and characterization of micro/nanostructures and microfluidic devices, a laboratory for prototyping electronic systems and a computer laboratory for multiphysics modeling and microelectronics design.

Research Lines

- Micro/Nanofabrication processes
- Electrokinetic manipulation of cells and particles in microfluidic devices
- Carbon Micro/Nanodevices for sensing and energy storage applications
- Biosensors

Recent Publications

- R Gallo, M. Sano, B Lapizco, R Davalos, "Joule heating effects on particle immobilization in insulator-based dielectrophoretic devices", *Elecrphoresis*, vol. 35, no. 2-3, pp 352–361, 2014.
- A Salazar, S Camacho, O Rossetto, S Martinez, "Towards a SPR-based Biosensing Platform incorporating a CMOS Active Column Sensor", *Analog Integrated Circuits and Signal Processing*, vol. 77, pp. 365-372, 2013.
- V Perez, V Ho, L Kulinsky, M Madou, S Martinez, "PPyDEP: A new approach to microparticle manipulation employing polymer-based electrodes", *Lab on a Chip*, vol. 13, no. 23, pp. 4642-4652, 2013.
- M Lopez, H Moncada, V Perez, B Lapizco, S Martinez, "An Electric Stimulation System for Electrokinetic Particle Manipulation in Microfluidic Devices", *Review of Scientific Instruments*, vol. 84, 035103, 2013.

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Strategic area: mechatronics

Information Technologies

Research Group with Strategic Focus

Information Technologies

Description

The group is interested in applying computer technology for solving national priority problems. Currently, we focus mainly on issues such as security, business intelligence, education, logistics and bioinformatics.

Research Lines

- Information and computational security
- Big data
- Intelligent assistants and tutors
- Supply chain
- Network of sensors
- Computational models for prediction and identification of rare genetic variables, impostors, instructions, malicious software, infection and genomic patterns

Recent Publications

- Camina J.B., Rodriguez J., Monroy R.(2014) towards a masquerade detection system based on user's tasks. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics).
- Camina J.B., Hernandez-Gracidas C., Monroy R., Trejo L.(2014) The Windows-Users and -Intruder simulations Logs dataset (WUIL): An experimental framework for masquerade detection mechanisms. Expert Systems with Applications.
- Valentin L., Murrieta-Cid R., Munoz-Gomez L., Lopez-Padilla R., Alencastre-Miranda M. (2014) Motion strategies for exploration and map building under uncertainty with multiple heterogeneous robots. Advanced Robotics.
- Munoz-Gomez L., Alencastre-Miranda M., Lopez-Padilla R., Murrieta-Cid R.(2011) Exploration and map-building under uncertainty with multiple heterogeneous robotsProceedings - IEEE International Conference on Robotics and Automation.
- Batyrshin I., Gonzalez-Mendoza M. (2014) Methods and applications of artificial and computational intelligence.Expert Systems with Applications.
- De Lourdes Martinez-Villasenor M., Gonzalez-Mendoza M., Valle I.D.D.(2014) Enrichment of learner profile with ubiquitous user model interoperability. Computacion y Sistemas.

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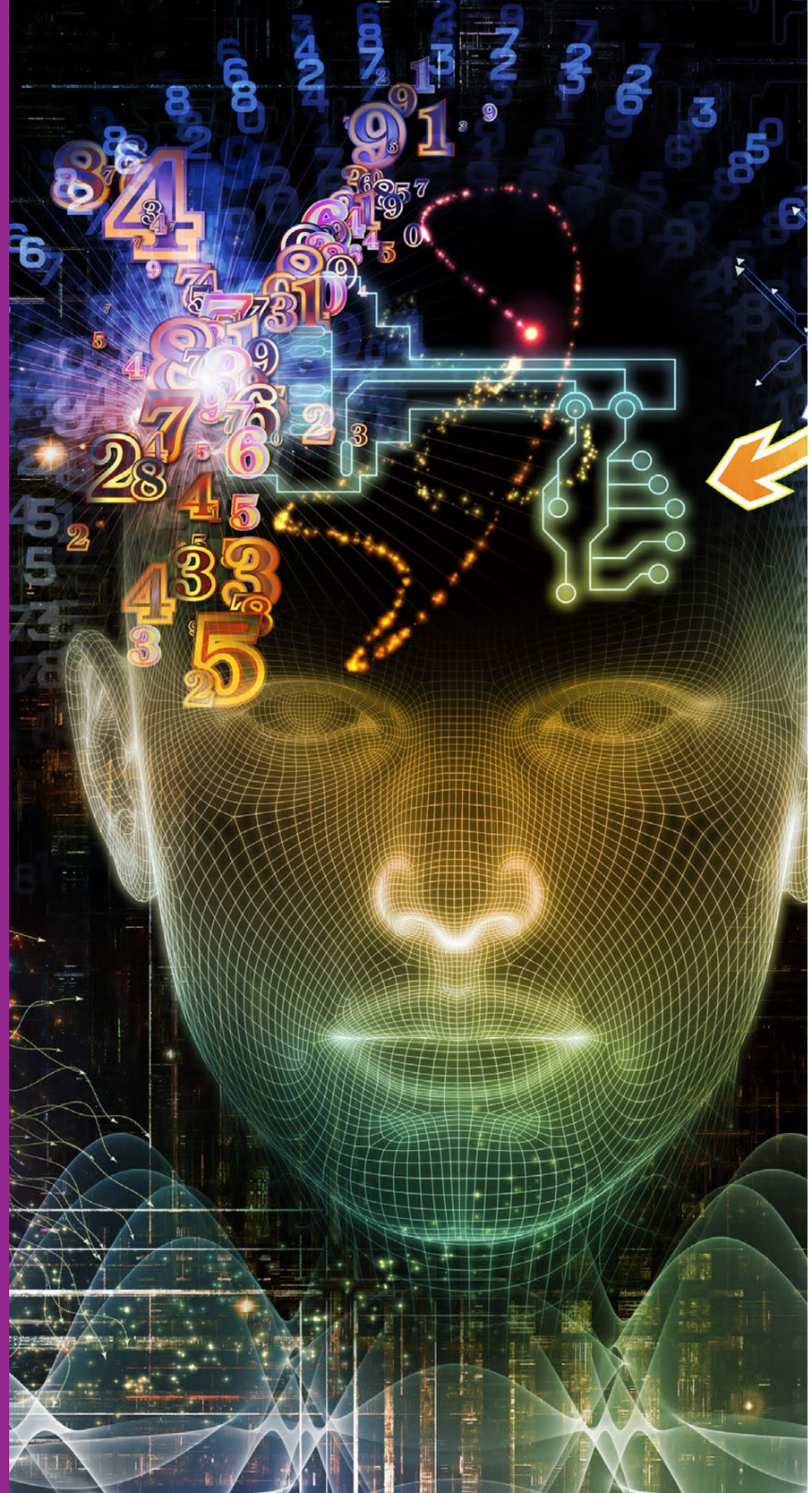
Intelligent Systems



Research Group with Strategic Focus

Intelligent Systems

Description

This group conducts basic and applied research to develop intelligent systems for solving problems across a wide range of application areas including optimization and logistics, ambient intelligence, web semantics, healthcare, forecasting and business intelligence, among others.
The investigation focuses on the development of innovative heuristic, metaheuristic and hyper-heuristic algorithms based on computational intelligence and other techniques to model and understand the complexity of the interaction between problems and algorithms with the intention to develop an automated and adaptable computational platform to efficiently solve a variety of real-world problems.
The group also explores strategies such as multi-agent systems, web semantics and data mining for integrating models and methodologies to trace a path toward intelligent organizations and more personalized systems.

Research Lines

- Nature-inspired systems
- Knowledge technologies

Recent Publications

- Herbert-Acero, J. F., Martínez-Lauranchet, J., Probst, O., Méndez-Díaz, S., Castillo-Villar, K., Valenzuela-Rendón, M. and Réthoré, P. A Hybrid Metaheuristic-Based Approach for the Aerodynamic Optimization of Small Hybrid Wind Turbine Rotors, Mathematical Problems in Engineering, Vol. 2014, Article ID 746319, 18 pages, 2014. doi:10.1155/2014/746319
- López-Camacho, E., Terashima-Marin, H., Ross, P. and Ochoa, G., A Unified Hyper-heuristic Framework for Solving Bin Packing Problems, Expert Systems with Applications, Volume 41, Issue 15, 1 November 2014, pp 6876-6889
- García-Ceja, E., Brena, R. F., Carrasco-Jiménez, J. C., Garrido, L., Long-term Activity Recognition from Wristwatch Accelerometer Data, Sensors 2014, 14, 22500-22524; doi:10.3390/s141222500
- Ortiz-Bayliss, J. C., Moreno-Scott, J. H., and Terashima-Marin, H., Automatic Generation of Heuristics for Constraint Satisfaction, G. Terrazas et al. (eds.) Nature-inspired Cooperative Strategies for Optimisation (NICSO 2013), Studies in Computational Intelligence 512, 2014, pp315-327, Springer

Patents

- Alanís-Reyes, E. A., Terashima-Marín, H. and Conant-Pablos , S. E., Método para Clasificación de Lesiones de Cáncer de Mama, con Respecto a su Contenido Visual y Casos Históricos Similares (Method to Classify Breast Cancer Lesions, with Respect to Visual Content and Similar Historical Cases), Instituto Mexicano de Propiedad Industrial, MX/E/2012/92423
- Nolazco-Flores, J A., Méndez-Ábrego, V. M., Method to Synthetize Voice Signals from Multimedia Objects, Instituto Mexicano de Propiedad Industrial, MX/a/2008/006219, granted in september 2013

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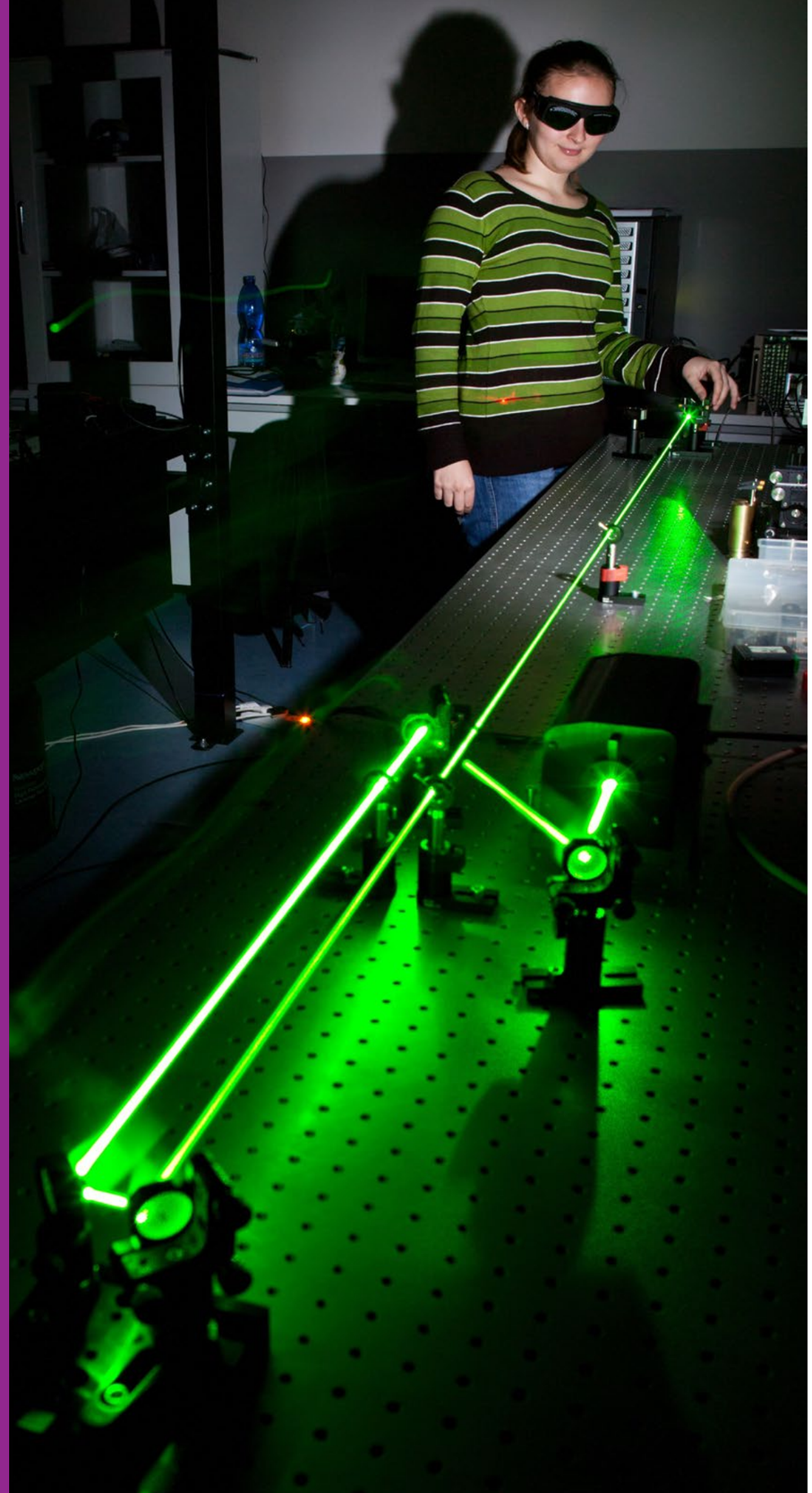
Optics and Lasers



Research Group with Strategic Focus

Optics and Lasers

Description

This group studies the application of light in micro-manipulation systems, quantum computing and characterization of micro and nanostructured materials including metamaterials. We develop special light profiles using lasers and other incoherent light sources. Lasers are one of the most important areas in scientific and applied research, they have been successfully applied in various fields such as medicine, metrology, telecommunications and biotechnology, among others.
In these applications, it is very important to control the widening of the beam as it propagates through the air. Several current research in optics are designed to minimize the light beams dispersion. Additionally, the group will explore the potential applications of these rays in the industry (drilling and cutting laser), biotechnology (optical tweezers) and metrology for materials characterization.

Research Lines

- Linear and nonlinear optics
- Lasers and metamaterials
- Information and quantum computing
- Characterization of materials by optical/chemical methods

Recent Publications

- Quasi one-dimensional optical lattices for soliton manipulation. Servando Lopez-Aguayo, Cesar Ruelas-Valdez, Benjamín Pérez-Garcia, Antonio Ortiz-Ambriz, Raul I. Hernandez-Aranda, and Julio C. Gutiérrez-Vega. Optics Letters. 39(22) 6545-6548 (2014)
- Manipulation of dielectric particles with nondiffracting parabolic beams Antonio Ortiz-Ambriz, Julio C. Gutiérrez-Vega, and Dmitri Petrov. J. Opt. Soc. Am. A 31(12) 2759-2762 (2014)
- Generation of rotary beams by interaction of moving solitons in nonlocal media. Gilberto Lem, Servando López-Aguayo, and Julio C. Gutiérrez-Vega. Physical Review A, 90, 053830 (2014)
- Orbital angular momentum of optical vortices from power measurements and the cross-correlation function. Benjamin Perez-Garcia, Dorilian Lopez-Mago, Hipolito Garcia-Gracia, Jorge A. Garza-Alanis, Raul I. Hernandez-Aranda, and Julio C. Gutié-rrez-Vega. Optics Letters, 39(7), 1929-1932 (2014)

Strategic area: information and comunication technologies

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Telecomunication and Networks

Research Group with Strategic Focus

Telecomunication and Networks

Description

The group works on signal processing for image processing as well as on the convergence between optical communications networks and wireless networks. The group also does research in the following areas: radio over fiber, photonic crystals, levels of physical layer, connectivity, modulation, configurable network architecture and sensors, optimization of optical and wireless networks and several applications such as medical, automotive and biological imaging, among others. Signal processing spans many applications such as images, video, audio, speech, communication codes, biological systems, geological systems, electric power systems, radar, sonar, automotive, signal integrity in RF, RF filtering, smart antennas, fractal signals, nonlinear systems, optical systems and quantum signal processing, among others. One of our research areas focuses on the understanding and development of mathematical algorithms for potential applications and the efficient implementation of such algorithms in DSP processors, specific software or architecture. It is also evident that telecommunications are developing almost exponentially worldwide in response to the ever-increasing bandwidth demand and transmission distances required in communication networks. The systems fit to cope with this exponential growth are led by optical networks. This group does research in long haul transmission systems, advance optical modulation formats, radio over fiber, convergence of networks, photonic crystals, network security and evolutionary algorithms applied to network optimization and design, evaluation of the performance of all-photonic networks and the application of new technologies as quantum security. The Wireless Communications group currently conducts research to improve essential understanding of the fundamental performance in the areas of wireless communications and networks such as 4G, 5G, cognitive radio, position location techniques, interference engineering and modeling, optimum receivers, ad-hoc and sensor networks, vehicular communications (V2V and V2I modeling), network coding, MIMO/massive MIMO, channel modeling, coexistence/collaboration/cooperation in wireless networks, CDMA, multiple access, among others.

Research Lines

- Wireless communication
- Optics and networks
- Signal processing

Recent Publications

- C Vargas-Rosales, J Mass-Sanchez, E Ruiz-Ibarra, D Torres-Roman, A. Espinoza-Ruiz, “Performance Evaluation of Localization Algorithms for WSNs,” *Accepted to International Journal of Distributed Sensor Networks*, Hindawi, February 10, 2015.
- Victor Perez-Gonzalez, David Munoz-Rodriguez, Cesar Vargas-Rosales, and Raul Torres-Villegas, “Relational Position Location in Ad-Hoc Networks,” *Ad-Hoc Networks*, Elsevier, vol. 24, Part A, pp. 20-28, January 2015
- Aldaya, I. ; Gosset, C. ; Wang, C. ; Campuzano, G. ; Grillot, F. ; Castañón, G.Periodic and aperiodic pulse generation using optically injected DFB laser Electronics Letters Volume: 51 ,pp 280 – 282, 2015
- Jorge A Seseña-Osorio1*, Ignacio E Zaldívar-Huerta1, Alejandro Aragón-Zavala2 and Gerardo A Castañón- Analysis and experimental evaluation of the frequency response of an indoor radiating cable in the UHF band *EURASIP Journal on Wireless Communications and Networking* 2015.

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Energy and Climate Change

Research Group with Strategic Focus

Energy and Climate Change

Description

The Energy and Climate Change (ECC) group consolidates the research interest of the School of Engineering and Sciences in the broad area of sustainable use of energy and environmental resources. The group incorporates faculty members from different engineering disciplines, including mechanical, electrical, chemical, environmental and forest engineering, as well as from the basic sciences, including physics and geophysics. In addition, faculty members from the EGADE Business School support the issues addressed by the ECC group from the business and economic perspectives. Three general topics are central for our research: efficient use of energy and clean technologies, renewable energy sources and environmental impact related to the energy sector with particular emphasis on climate change and air resources. The faculty members conduct applied research in their areas of interest and seek to establish connections from different technological points of view in order to form the “big picture” of economic and environmental implications.

Research Lines

• Energy: generation, conversion, transport and efficiency
• Renewable energy sources: wind, sun and biomass
• Climate change: mitigation, adaptation and environmental co-benefits

Recent Publications

• Cárdenas D., Elizalde H., Marzocca P., Probst O., Ramirez R., Toledo J. (2014) The Poly-SAFE method: A semi-analytical representation of finite element models via nested polynomial reduction of modal data. Composite Structures, 111, 301-316.
• Elizondo J.L., Olloqui A., Rivera M., Macías M.E., Probst O., Micheloud O.M., Rodriguez J. (2014) Model-Based Predictive Rotor Current Control for Grid Synchronization of a DFIG Driven by an Indirect Matrix Converter. IEEE Journal of Emerging and Selected Topics in Power Electronics, 2(4), 715-726.
• Huertas J.I., Huertas M.E., Cervantes G., Díaz J. (2014) Assessment of the natural sources of particulate matter on the opencast mines air quality. *Science of the Total Environment*, 493, 1047-1055.
• Ibarra-Yunez, A. (2015). “Energy Reform, Governance Changes in the Hydrocarbon Sector and their NAFTA implications after 21 Years.” México. Foro Internacional. Colegio de México. January-March.
• Mancilla Y., Herckes P., Fraser M., Mendoza A. (2015) Secondary Organic Aerosol Contributions to PM2.5 in Monterrey, Mexico: Temporal and Seasonal Variation. *Atmospheric Research*, 153, 348-359.
• Serrano-Arellano J., Gijon-Rivera M., Riesco-Ávila J.M., Xamán J., Álvarez G. (2014) Numerical investigation of transient heat and mass transfer by natural convection in a ventilated cavity: Outlet air gap located close to heat source. *International Journal of Heat and Mass Transfer*, 76, 268-278.
• *Solar-Energy Powered Machine for Cooling Ammonia by Absorption*. Inventors: Alejandro J García Cuéllar, Carlos I Rivera Solorio, Gloria M López Navarro, José L López Salinas. MX Patent: 318066. Date issued: 29/01/2014.

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Water Science and Technology

Research Group with Strategic Focus

Water Science and Technology

Description

This research group performs several activities related to the management of water resources and engineering for sustainable use in the following areas: a) hydrological processes focused on the management of water resources in the area basin; b) environmental process focused on developing biorefineries and new green technologies; c) environmental geoprocesses focused on the study of the environmental impact in the subsoil related to human activities; and d) environmental nanotechnology focused on the development of new and advanced materials.

Research Lines

- Environmental nanoprocesses and chemistry
- Environmental geoprocesses
- Hydrological processes and water resources management
- Environmental bioprocesses

Recent Publications

- Ledesma-Ruiz, R., Pastén-Zapata, E., Parra, R., Harter, T., Mahlknecht (2015) Investigation of the geochemical evolution of groundwater under agricultural land: A case study in northeastern Mexico. J. Journal of Hydrology 521, pp. 410-423.
- Ramírez-Cavazos, L.I., Junghanns, C., Ornelas-Soto, N., Cárdenas-Chávez, D.L., Hernández-Luna, C., Demarche, P., Enaud, E., García-Morales, R., Agathos, S.N., Parra, R. (2014) Purification and characterization of two thermostable laccases from Pycnoporus sanguineus and potential role in degradation of endocrine disrupting chemicals. Journal of Molecular Catalysis B: Enzymatic 108, pp. 32-42.
- Alemán-Nava, G.S., Casiano-Flores, V.H., Cárdenas-Chávez, D.L., Díaz-Chavez, R., Scarlat, N., Mahlknecht, J., Dallemand, J.-F., Parra, R. (2014) Renewable energy research progress in Mexico: A review. Renewable and Sustainable Energy Reviews. Volume 32, April 2014, Pages 140-153.
- Pastén-Zapata, E., Ledesma-Ruiz, R., Harter, T., Ramírez, A.I., Mahlknecht, J. (2014) Assessment of sources and fate of nitrate in shallow groundwater of an agricultural area by using a multi-tracer approach. Science of the Total Environment 470-471, pp. 855-864.
- Stoyko, J.E., Ramírez A.I. (2013) Real-time forecasting of flows WIT Transactions on Ecology and the Environment 178, pp. 285-296.

Strategic area: *sustainable technologies*

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School of Medicine

- Bioinformatics and Medical Devices
- Cell Therapy
- Clinical Innovation
- Molecular Medicine

Bioinformatics and Medical Devices

Research Group with Strategic Focus

Bioinformatics and Medical Devices

Description

This group focuses its research on topics of bioinformatics, genomics, medical imaging and medical devices. In bioinformatics, we focus on: algorithms and experiments for analysis, identification and validation of diagnostic biomarkers and forecasts for diseases (including cancer) and stem cells differentiation processes. We perform computational trials (ie: Machine Learning, Artificial Intelligence) and experiments (i.e: cuture, RT-PCR, transcriptomics and genomics). In genomics, we focus on the analysis, identification and validation of mutations, genetic and epigenetic alterations in various diseases and in the use of genomic technologies such as next-generation sequencing (NGS). In Medical Imaging, we focus on computer aided diagnosis and detection via analysis, identification and validation of imaging markers in various diseases including cancer. We are interested in algorithms, techniques and computational models for obtaining knowledge and improving clinical medical diagnosis and prognosis. We also focus on correlations between medical imaging and molecular data. In Medical Devices, we research and develop medical technology to promote innovations in diagnosis, treatment, therapy and assistance for people with disabilities, especially in pediatrics. We study the design of new robotic rehabilitation schemes to lessen the level of disability in patients with SCI or EVC sequel and enable their inclusion in social and productive activities. All these efforts are based on personalized medicine.

Research Lines

- Molecular biomarkers
- Imaging biomarkers
- Genomic of diseases
- Drug delivery methods
- Rehabilitation devices

Recent Publications

- Comparison of gene expression patterns across twelve tumor types identifies a cancer supercluster characterized by TP53 mutations and cell cycle defects. Oncogene. 2014.
- Landscape of Genomic Alterations in Cervical Carcinomas. Nature. 2014
- Magnetization-prepared rapid acquisition with gradient echo magnetic resonance imaging signal and texture features for the prediction of mild cognitive impairment to Alzheimer's disease progression. Journal of Medical Imaging. 2014
- SurvExpress: An online biomarker validation tool and database for cancer gene expression data using survival analysis. PLOS One. 2013

Patent

- Sistema Y Método Para La Obtencion Biomarcadores Para El Diagnostico Y Prognosis Clínica A Través Del Análisis Digital De Imágenes Médicas. México 2010. Expediente MX/a/2010/014267. Folio MX/E/2010/080908

Strategic area: health

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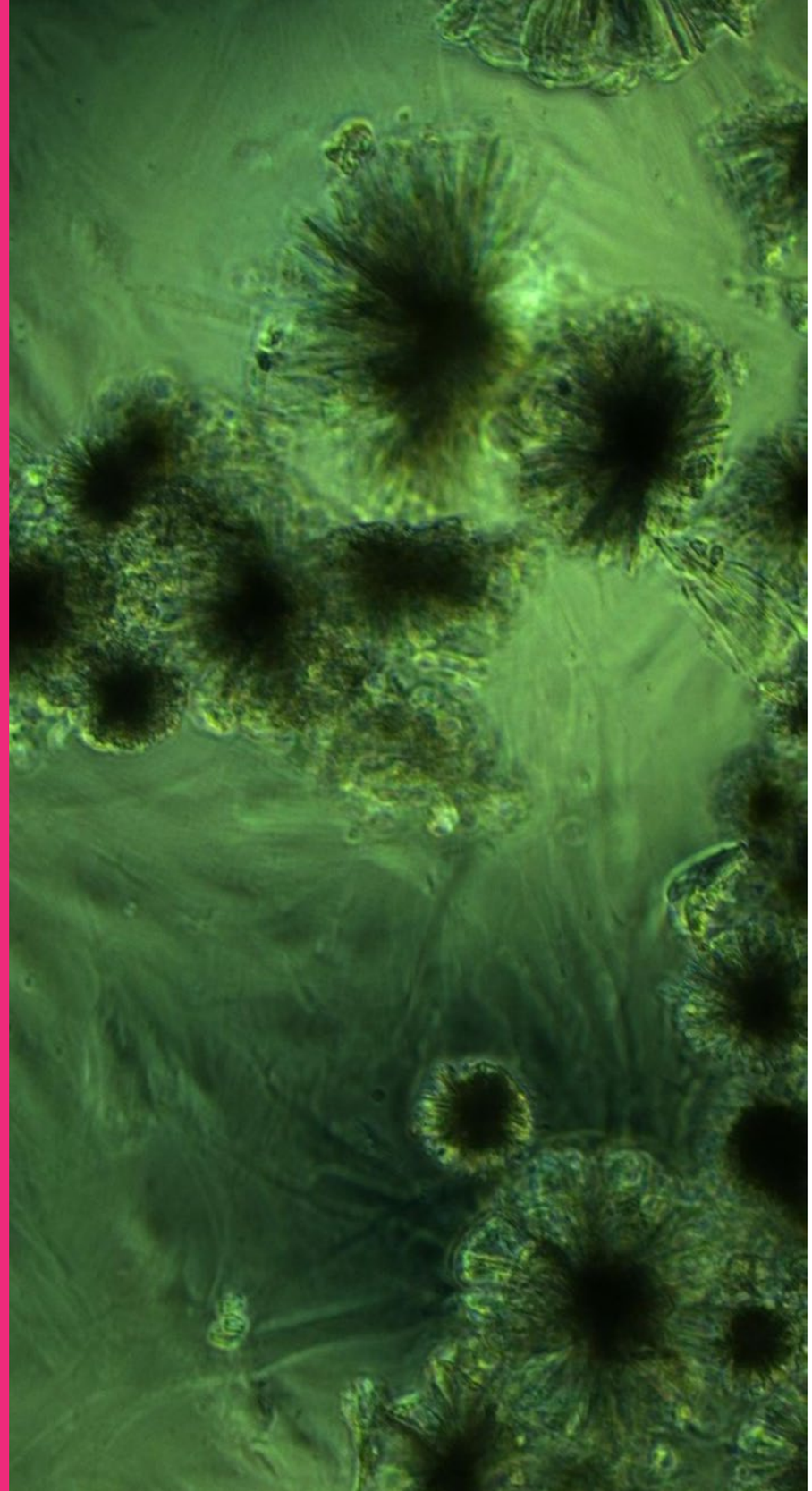

Cell Therapy

Research Group with Strategic Focus

Cell Therapy

Description

We are dedicated to the study, isolation, expansion and characterization of stem cells –from hematopoietic and adipose tissue– for its use in regenerative medicine programs. The group has an extensive experience in the development of differentiation protocols for specific cell lineages. This cells therapy, through autologous transplantation, is used by our group to improve the quality of life of patients suffering chronic degenerative diseases of the nervous system such as amyotrophic lateral sclerosis (ALS) and Parkinson's disease. We are recognized as a world reference in the ALS therapeutic approach. In the near future, preclinical models in animals will be ready to support the use of these cells in diabetes mellitus treatment.

Research Lines

• Isolation and culture of stem cells for potential therapeutic use

Recent Publications

• Martinez H.R., Marioni S.S., Escamilla Ocanas C.E., Gonzalez Garza M.T., Moreno-Cuevas J.E.(2014) Amyotrophic lateral sclerosis in pregnancy: Clinical outcome during thepost-partum period after stem cell transplantation into the frontal motor cortex. Cytotherapy.

• Martinez H.R., Molina-Lopez J.F., Gonzalez-Garza M.T., Moreno-Cuevas J.E., Caro-Osorio E., Gil-Valadez A., Gutierrez-Jimenez E., Zazueta-Fierro O.E., Alfonso Meza J., Couret-Alcaraz P., Hernandez-Torre M.(2012) Stem cell transplantation in amyotrophic lateral sclerosis patients: Methodological approach, safety, and feasibility. Cell TransplantationArticle.

• Duval F., Moreno-Cuevas J.E., Gonzalez-Garza M.T., Rodriguez-Montalvo C., Cruz-Vega D.E.(2014)Protective mechanisms of medicinal plants targeting hepatic stellate cell activation and extracellular matrix deposition in liver fibrosis. Chinese Medicine (United Kingdom).

• Elizondo-Montemayor L., Moreno-Sanchez D., Gutierrez N.G., Monsivais-Rodriguez F., Martinez U., Lamadrid-Zertuche A.C., Hernandez-Torre M.M.(2014) Individualized tailor-made dietetic intervention program at schools enhances eating behaviors and dietary habits in obese hispanic children of low socioeconomic status. The Scientific World Journal.

• Santos-Guzman J., Madrigal-Avila C., Hernandez-Hernandez J.A., Mejia-Velazquez G., Erana-Rojas I.E., Elizondo-Montemayor L., Villela L.2014A decade of lead monitoring in schoolchildren in the metropolitan area of Monterrey NL, Mexico [Una década de monitoreo de plomo en sangre en niños escolares del área metropolitana de Monterrey, NL]. Salud Pública de México.

Strategic area: health

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Clinical Innovation

Research Group with Strategic Focus

Clinical Innovation

Description

This group develops activities focused on the diagnosis, treatment and prevention of diseases. We study our country's major challenges from a traslational approach integrating basic and applied research projects that propose solutions needed for the treatment of the people who are at risk. Our research focuses on metabolic syndrome, blindness and surgery as well as maternal and child binomial.

Research Lines

• Traslational medicine

Recent Publications

• Bayod, S., Guzmán-Brambila, C., Sanchez-Roige, S., Lalanza, J.F., Kaliman, P., Ortuño-Sahagun, D., Escorihuela, R.M., Pallàs, M. (2014). Voluntary Exercise Promotes Beneficial Anti-aging Mechanisms in SAMP8 Female Brain. Journal of Molecular Neuroscience.

• Jauregui-Jauregui J.A., Mendez-Acosta H.O., Gonzalez-Alvarez V., Snell-Castro R., Alcaraz-Gonzalez V., Godon J.J.(2014) Anaerobic treatment of tequila vinasses under seasonal operating conditions: Start-up, normal operation and restart-up after a long stop and starvation period. Bioresource Technology.

• Rodriguez de Ita J., Torres-Quintanilla A., Palau-Davila L., Silva-Gburek J.C., Ortiz de Elguea-Lizarraga J., Chavez Caraza K.L., Santos Guzman J.(2014) Clinical score to rule out pneumonia due to Mycoplasma pneumoniae [Score clínico para el descarte de neumonía por Mycoplasma pneumoniae]. Anales de Pediatria.

• Vazquez-Armenta G., Gonzalez-Leal N., la Torre M.J.V., Munoz-Valle J.F., Ramos-Marquez M.E., Hernandez-Canaveral I., Plascencia-Hernandez A., Siller-Lopez F. (2013) Short (GT)n microsatellite repeats in the heme oxygenase-1 gene promoter are associated with antioxidant and anti-inflammatory status in Mexican pediatric patients with sepsisTohoku. Journal of Experimental Medicine.

• Figueroa-Garcia I., Sanchez-Sosa G., Diaz-Dominguez R., Rodriguez-Villagomez F., Huegel J.C., Garcia-Gonzalez A.(2012) A nonparametric modeling approach of soft tissue deformation by ANFISProceedings of the IEEE RAS and EMBS International. Conference on Biomedical Robotics and Biomechatronics.

• Osuna P.M., Santos-Guzman J., Villela L., Cedillo-Aleman E.J., Garcia A. (2012). Osteopetrosis - Calcification beyond the skeletal system. A case report. Boletin Medico del Hospital Infantil de Mexico.

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Strategic area: health

Molecular Medicine

Research Group with Strategic Focus

Molecular Medicine

Description

We study molecular and cellular alterations in the development of diseases and their treatments.

Research Lines

• Pathophysiological study at cellular and molecular levels

Recent Publications

• Metra M., Cotter G., El-Khorazaty J., Davison B.A., Milo O., Carubelli V., Bourge R.C., Cleland J.G., Jondeau G., Krum H., O'Connor C.M., Parker J.D., Torre-Amione G., Van Veldhuisen D.J., Rainisio M., Kobrin I., McMurray J.J., Teerlink J.R.(2015) Acute heart failure in the elderly: Differences in clinical characteristics, outcomes, and prognostic factors in the Veritas study. Journal of Cardiac Failure.

• Trachtenberg B.H., Cordero-Reyes A.M., Aldeiri M., Alvarez P., Bhimaraj A., Ashrith G., Elias B., Suarez E.E., Bruckner B., Loebe M., Harris R.L., Zhang J.Y., Torre-Amione G., Estep J.D.(2015) Persistent blood stream infection in patients supported with a continuous-flow left ventricular assist device is associated with an increased risk of cerebrovascular accidents. Journal of Cardiac Failure.

• Fajardo-Ramirez O.R., Salas-Alanis J.C., Guzman-Huerta E., Martinez U., Barbosa A., Scott S.-P., Hernandez-Hernandez J.A., Villela L.M.(2014) BRAF mutations among patients from the Northeast of México with malignant melanoma. Revista de Investigacion Clinical.

• Fernandez-Sada E., Silva-Platas C., Villegas C.A., Rivero S.L., Willis B.C., Garcia N., Garza J.R., Oropeza-Almazan Y., Valverde C.A., Mazzocchi G., Zazueta C., Torre-Amione G., Garcia-Rivas G.(2014) Cardiac responses to β-adrenoceptor stimulation is partly dependent on mitochondrial calcium uniporter activityBritish. Journal of Pharmacology.

• Quintanilla J., Avila C., Meraz M., Jerjes-Sanchez C., de la Pena-Almaguer E., Diaz-Cid A., Sanchez L., Trevino A.R., Perez L.C. (2015T) he role of a multimodality imaging approach in diagnosis and stratification of aborted sudden cardiac death. Canadian Journal of Cardiology.

• Ayers S., Switnicki M.P., Angajala A., Lammel J., Arumanayagam A.S., Webb P.2014Genome-wide binding patterns of thyroid hormone receptor beta. PLoS ONE.

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